

HISTORY OF WEATHER OBSERVATIONS  
Vicksburg, Mississippi  
1849 - 1955

July 2006

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# TABLE OF CONTENTS

<b>ACKNOWLEDGMENTS</b>	<b>ii</b>
<b>LIST OF ILLUSTRATIONS</b>	<b>iii</b>
<b>INTRODUCTION</b>	
<b>Historical Overview</b>	<b>1</b>
<b>Goal of the Study</b>	<b>3</b>
<b>LOCATION OF OBSERVATIONS</b>	
<b>Structured Weather Observing Programs during the Mid 1800s</b>	<b>4</b>
<i>Smithsonian Observations (March 1849-December 1852)</i>	<b>4</b>
<i>Weather Observations by Army Surgeons (September 1866-June 1870)</i>	<b>4</b>
<b>Signal Service and Weather Bureau Observations</b>	<b>5</b>
<i>Signal Service Observations (September 1871-July 1891)</i>	<b>5</b>
<i>Weather Bureau Observations (July 1891 through 1955)</i>	<b>7</b>
<i>Aviation Weather Observations (September 1938 through 1955)</i>	<b>8</b>
<b>INSTRUMENTATION</b>	
<b>Structured Weather Observing Programs during the mid 1800s</b>	<b>10</b>
<i>Smithsonian Observations (March 1849-December 1852)</i>	<b>10</b>
<i>Weather Observations by Army Surgeons (September 1866-June 1870)</i>	<b>10</b>
<b>Signal Service and Weather Bureau Observations</b>	<b>11</b>
<i>Signal Service Observations (September 1871-October 1872)</i>	<b>12</b>
<i>Weather Bureau Observations (July 1891 Through 1955)</i>	<b>26</b>
<i>Aviation Weather Observations (September 1938 through 1955)</i>	<b>37</b>
<b>BIBLIOGRAPHY</b>	<b>44</b>
<b>APPENDIX</b>	
<b>Methodology</b>	<b>46</b>

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Nancy Bell, Executive Director of the Vicksburg Foundation for Historic Preservation, took time to meet with the author and answer a number of questions. She also provided copies of Vicksburg city directories and Sanborn Insurance Maps for the periods of interest. Her expertise was crucial in answering a number of critical questions.

## LIST OF ILLUSTRATIONS

### Figures

1. Location of Vicksburg, Mississippi	1
2. Location of McPherson Hospital	5
3. Signal Service and Weather Bureau Observing Stations	6
4. Location of Aviation Weather Observations	8
5. Smithsonian Weather Observations	10
6. Army Surgeon Weather Observations	11
7. View of Vicksburg	12
8. Hunt Building Location	13
9. Signal Service Office in Hunt Building	14
10. Roof of the Hunt Building	15
11. Baum Building Location	16
12. Signal Service Office in Baum Building	17
13. Window Instrument Shelter in Baum Building	19
14. U.S. Engineers Building Location	21
15. Signal Service Office in Engineers Building	22
16. Hall's Building Location	23
17. Signal Service Office in Hall's Building	24
18. Signal Service Office in the Baum Building	25
19. Roof of the Baum Building	26
20. Weather Bureau Office in the Post Office Building	28
21. Roof of the Post Office Building	29
22. General Location of Weather Instruments on Post Office Roof	30
23. Wind Instruments on the Post Office Roof	31
24. Weather Instruments on the Roof of the Post Office & Courthouse Building	32
25. Weather Instruments on the Roof of the Post Office & Courthouse Building	33
26. Schematic of the Roof of the Post Office & Courthouse Building	34
27. General View of Weather Instruments at the Post Office & Courthouse Bldg.	35
28. Proximity of the Two Post Office Buildings used by the Weather Bureau	37
29. CAA Office and Weather Instruments at Old Vicksburg Municipal Airport	38
30. Weather Instruments at the Old Vicksburg Municipal Airport	39
31. Weather Instruments at the Old Vicksburg Municipal Airport	39
32. CAA Office and Weather Instruments at New Vicksburg Airport	41
33. Approximate Location of Weather Instruments at New Vicksburg Airport	42
34. Airport Administration Building at New Vicksburg Municipal Airport	43

# HISTORY OF WEATHER OBSERVATIONS

Vicksburg, Mississippi

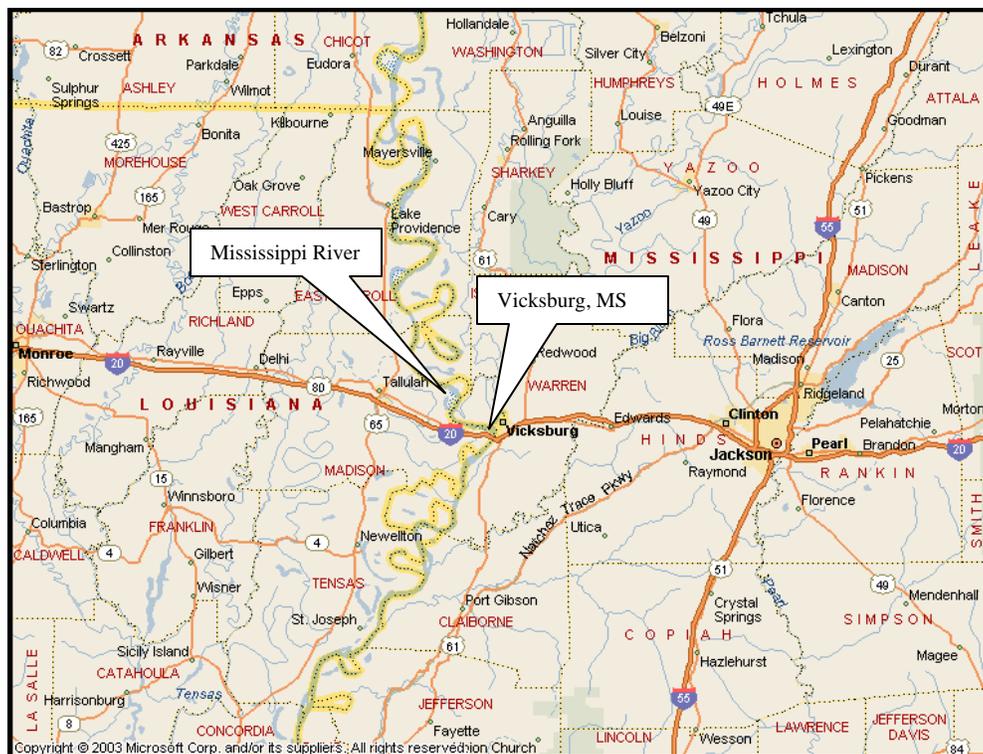
1849 – 1955

Gary Grice

## INTRODUCTION

### Historical Overview

Vicksburg, MS is located in western Mississippi along the border with Louisiana and on the Mississippi River (Figure 1).



**Figure 1. Location of Vicksburg, Mississippi, plotted on a current map. East-west distance across the map is approximately 140 miles.**

The area around Vicksburg was recognized long ago as a natural gateway of importance when the Spanish erected a post in 1791 called Fort Nogales. The city of Vicksburg was founded in 1819 by Newit Vick, a Methodist minister and was incorporated in 1825 with a population of 180.

The Mississippi River has been a major part of the history of Vicksburg. Over the years, the river has influenced the historic and economical development of the city.

Located on bluffs as much as 200 feet above the river, Vicksburg was a center of riverboat activity during the 1800s, primarily for the shipment of cotton to market. However, travel on the Mississippi was dangerous and unreliable, and in 1831, the Vicksburg and Clinton Railroad was organized for overland trade. The 1831 railroad was local, but by 1846 had spread across the state.

Cotton made the city of Vicksburg prosperous, as riverboats and trains carried the important product to markets up north and overseas. This prosperity helped establish Vicksburg as the commercial, financial, and social center for the area and an important city of the South during the early and mid 1800s. The city was not only important for the trade of cotton on the river and over the railroads, but it also supplied products to the plantations of western Mississippi, eastern Louisiana, and southeast Arkansas.

The center of Vicksburg on the Mississippi River and southern railroad system made it strategically important during the Civil War. Following the fall of New Orleans and Baton Rouge, the attention of the Union focused on the “Gibraltar of the Mississippi.” On 4 July 1863, Vicksburg surrendered to Union forces following a 47 day siege. After the Civil War, the economy of the South was destroyed as the former Confederate States struggled with reconstruction. In addition, in 1876 the Mississippi River made a course change that essentially destroyed the railway and river port system of Vicksburg. The economic effect on the city was devastating.

In 1878, the city appealed to the Federal government, and following an extensive study, the Corps of Engineers undertook a massive project of diverting the Yazoo River south to serve as a diversion canal to replace the course change of the Mississippi. The project was completed on 7 January 1903, re-establishing Vicksburg as a river city.

The city prospered during the late 1800s and early 20<sup>th</sup> Century, serving as a “shopping center” for a large area of western Mississippi and eastern Louisiana. The Vicksburg National Military Park, constructed by the U.S. Government to commemorate the historic battle of 1863, is the center of an area rich in history.

First weather observations in the National Climatic Data Center (NCDC) database were in 1849 by a Smithsonian observer. These observations continued through 1852. No weather observations were found for Vicksburg from 1853 until 1866 when U.S. Army surgeons began taking observations as part of their routine duties. This program continued into 1870.

The first Signal Service office opened in Vicksburg in 1871 and continued to take weather observations into 1891 when the program was transferred to the U.S. Weather Bureau. The Weather Bureau continued the observation program in Vicksburg through 1955.

## **Goal of the Study**

The goal of this study is to document the primary weather observational path at Vicksburg, MS leading to the Weather Bureau observing program in the first half of the 20<sup>th</sup> Century. Descriptions of Vicksburg weather observations since around 1950 are available through easily obtainable climatic records, with the challenge being to identify and define the roots of the path that began in the 1800s and continued through times of significant transition in the early 1900s. Extrinsic observations, i.e., those by Smithsonian and Voluntary (or Cooperative) observers, are considered in relation to the beginning of the central observational stream eventually established by the Army surgeons, Signal Service, and subsequently, the Weather Bureau. This does not minimize the importance of these collateral observations, but rather focuses on the original events that led to the routine, formal weather observing program of modern times.

## LOCATION OF OBSERVATIONS

An article in the Vicksburg Evening Post on 31 May 1937 briefly described the history of the Vicksburg Weather Bureau office. In that article, R.T. Lindley, Meteorologist in Charge, stated the local office had unofficial records kept by Dr. C.P. Coffin and others dating back as early as 1840. A document prepared by the U.S. Signal Service around 1890 also indicated that weather observations in Vicksburg began in 1840. However, no additional information was found with regard to these early observations. Staff at the U.S. Army Corps of Engineers, Vicksburg District, stated the early records likely were destroyed when the Vicksburg Weather Bureau office closed in the 1960s. The records were not available at the Public Library, Historical Society, or at the Mississippi Department of Archives and History.

### **Structured Weather Observing Programs during the Mid 1800s**

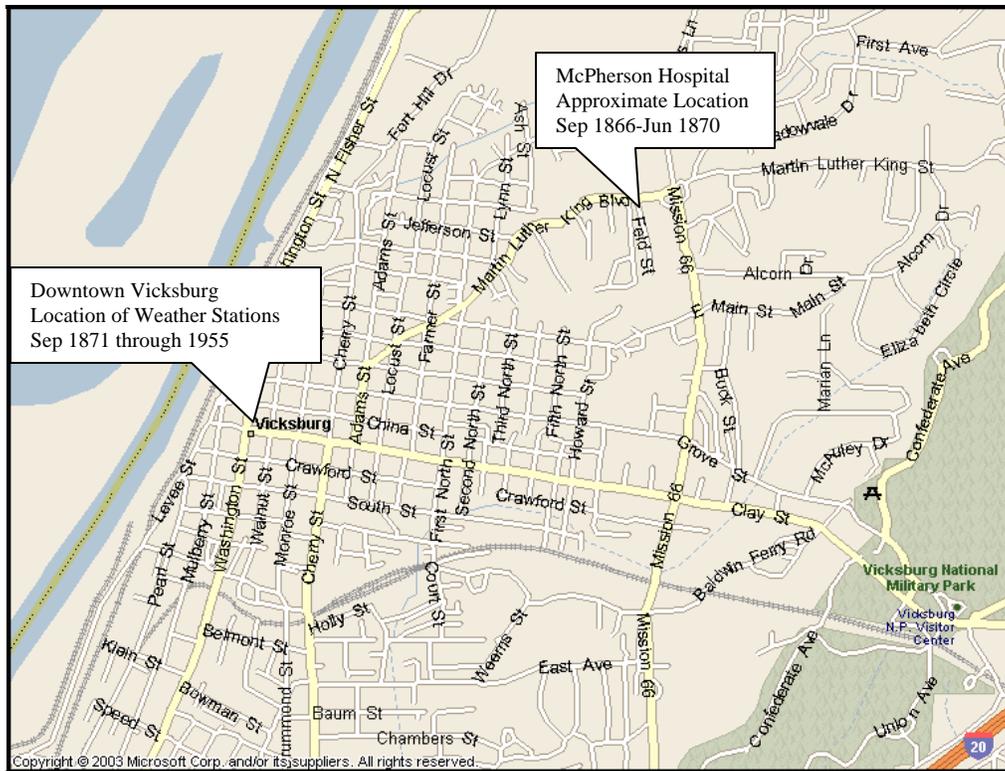
#### *Smithsonian Observations (March 1849-December 1852)*

The first weather observation listed for Vicksburg in the National Climatic Data Center (NCDC) database was on 1 March 1849 by A.L. Hatch as part of the Smithsonian Institution weather observing program. According to Smithsonian records, as well as the NCDC database, A.L. Hatch took weather observations from 1849 through 1852. The last observation was on 31 December 1852. Latitude/longitude coordinates were indicated on only the early observation forms and were inconclusive. No elevation was listed. No information could be found on the location of this station, but it likely was near downtown.

#### *Weather Observations by Army Surgeons (September 1866-June 1870)*

No weather observations were found for Vicksburg from January 1853 until 1 September 1866--first observations by Army surgeons. Latitude/longitude coordinates and elevation were not listed on the observation forms. The surgeon occasionally signed the forms as, "In Charge of 2<sup>nd</sup> Battalion, 15<sup>th</sup> U.S. Infantry." Observations by Army surgeons were available until 3 June 1870.

No official information was found regarding the location of the hospital where the Army surgeons took their weather observations. The historian for the Vicksburg National Military Park stated the most likely location was the McPherson Hospital that was located in northeast Vicksburg, approximately one mile from downtown (see Figure 2).



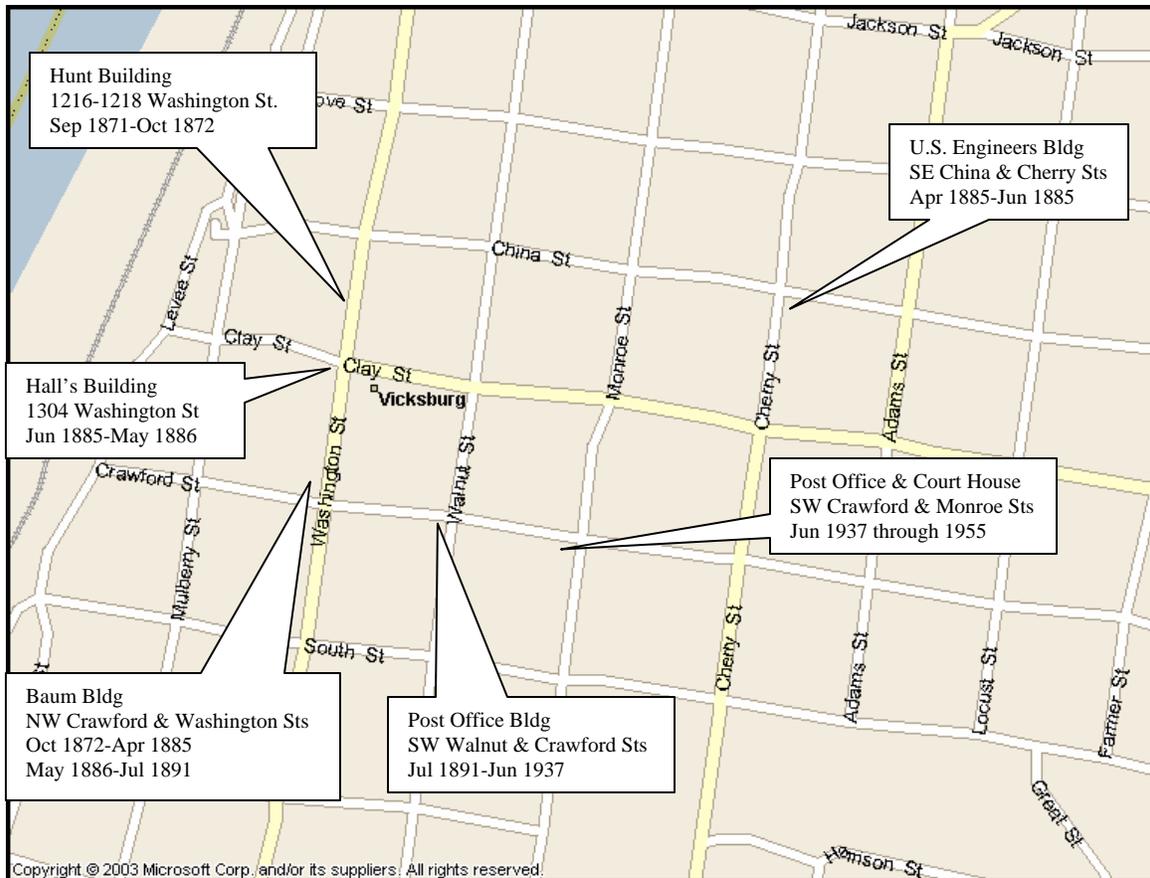
**Figure 2. McPherson Hospital where U.S. Army surgeons likely took weather observations from 1 September 1866 through 3 June 1870. Information plotted on a current map of Vicksburg. North is at the top of the page and east-west distance across the map is approximately two and one-half miles.**

## **Signal Service and Weather Bureau Observations**

### *Signal Service Observations (September 1871-July 1891)*

NOTE – All Signal Service and Weather Bureau station elevations in this report are for office barometers unless otherwise indicated. All elevations related to barometers in this report are above sea level unless otherwise indicated.

Figure 3 shows the locations of Signal Service and Weather Bureau stations in Vicksburg from September 1871 through 1955. For the 83 year period, weather observations in Vicksburg were all taken within an area little larger than three city blocks.



**Figure 3. Locations of Signal Service and Weather Bureau observing stations from September 1871 through 1955, plotted on a current map of Vicksburg. North is at the top of the page. East-west distance across the map is approximately six-tenths mile.**

8 September 1871 – 1 October 1872

- Hunt Building, 1216-1218 Washington Street
- The address in 1871/1872 was 139 Washington Street
- Located north of Clay Street on the west side of Washington
- The office was on the third floor in the northwest part of the building
- Listed elevation 230 feet
- GPS coordinates 32°21'2"N 90°52'41"W

1 October 1872 – 21 April 1885

- Baum Building, NW corner of Washington and Crawford Streets
- Office was located on the third floor in the southeast part of the building
- Located 400 feet south southwest of Hunt Building
- Elevation listed as 244 feet
- GPS coordinates 32°20'57"N 90°52'56"W
- Building destroyed by fire 21 April 1885 and office forced to move

21 April 1885 – 1 June 1885

- U.S. Engineers Building, Cherry and China Streets
- Southeast corner of intersection
- Also called the Martin Building
- Located 1,500 feet east northeast of Baum Building
- Elevation 253 feet
- GPS coordinates 32°21'2"N 90°52'41"W

1 June 1885 – 1 May 1886

- Hall's Building, 1304 Washington Street, southwest corner
- Address in 1885 was 149 Washington Street
- Located on the third floor
- Located 1,400 feet west southwest of the U.S. Engineers Building
- Elevation 210 feet
- GPS coordinates 32°21'00"N 90°52'56"W

1 May 1886 – 1 July 1891

- Baum Building (rebuilt after fire), 3<sup>rd</sup> floor
- NW corner of Washington and Crawford Streets
- Located 275 feet south southwest of Hall's Building
- Elevation 223 feet
- GPS coordinates 32°20'57"N 90°52'56"W

*Weather Bureau Observations (July 1891 through 1955)*

1 July 1891 – 1 March 1898

- Post Office Building, 3<sup>rd</sup> floor, SW corner Walnut and Crawford Streets
- Located 450 feet southeast of Baum Building
- Elevation 254 feet
- GPS coordinates 32°20'57"N 90°52'52"W

1 March 1898 – 6 October 1914

- Post Office Building, Room 215-217 on 2<sup>nd</sup> floor,
- Southwest corner Walnut and Crawford Streets
- Same location as previous station, different floor
- Elevation 247 feet
- GPS coordinates 32°20'57"N 90°52'52"W

6 October 1914 – 12 June 1937

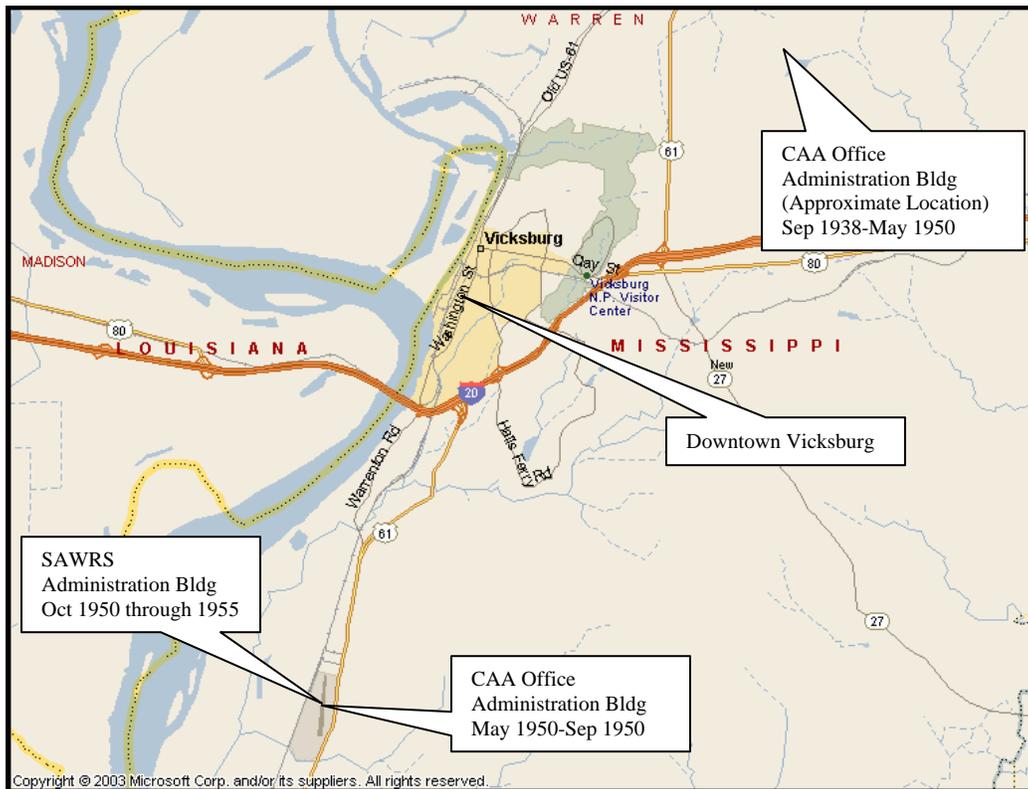
- Post Office Building, Rooms 201-203 on 2<sup>nd</sup> floor,
- Southwest corner of Walnut and Crawford Streets
- Same location and same floor as previous station, different rooms
- Elevation 247 feet
- GPS coordinates 32°20'57"N 90°52'52"W

12 June 1937 through 1955

- Post Office & Courthouse, southwest corner Crawford & Monroe Streets
- Rooms 500, 501-A, and 501
- Located 300 feet east of previous location (Post Office Building)
- Elevation 295 feet
- GPS coordinates 32°20'56"N 90°52'48"W

*Aviation Weather Observations (September 1938 through 1955)*

Figure 4 shows the locations of the airport observations at Vicksburg, MS.



**Figure 4. Aviation weather observations taken at the two Vicksburg, MS airports from September 1938 through 1955, plotted on a current map of the area. North is at the top of the figure. East-west distance across the map is approximately 17 miles.**

2 September 1938 – 22 May 1950

- Ground floor, Administration Building, Old Municipal Airport
- Exact location could not be determined
- Approximately 7 miles NE of downtown on Oak Ridge Road
- Initially listed as a U.S. Airway Communications Station with the name changed to CAA office/station around 1940
- Elevation 263 feet
- The airport was a grass runway

22 May 1950 – 30 September 1950 (CAA Station Closed)

- 2<sup>nd</sup> floor, Administration Building, New Vicksburg Municipal Airport
- Located 14 miles southwest of previous station at old Municipal Airport.
- Elevation 122 feet
- The CAA office closed 30 September 1950

16 October 1950 through 1955

- Supplementary Aeronautical Weather Reporting Station (SAWRS) established
- Operated by Southern Airways
- 1<sup>st</sup> floor, Administration Building, New Vicksburg Municipal Airport
- Same location as previous CAA station but the office moved from the second to the first floor
- Field elevation 111 feet

# INSTRUMENTATION

## Structured Weather Observing Programs during the Mid 1800s

*Smithsonian Observations (March 1849-December 1852)*

A.L. Hatch took weather observations in Vicksburg for the Smithsonian Institution from 1849 through 1852. The first observation was 1 March 1849 (Figure 5) with sporadic observations (in the NCDC database) through December 1852. No observations were available for 1850.

*Station Vicksburg Miss. Latitude 32° 25' 40" N. Longitude 90° 16' W.  
March 1849*

Date	Height	Thermometer		Direction of Wind			Force of Wind			Weather			Quantity Rain	Remarks	
		Surf Air	Shade	Surf	Dir	Dist	Surf	Dir	Dist	Surf	Dir	Dist			
1 <sup>st</sup>	1	55	65	64	S	S	W	2	1	1	2	1	1	1	fair
2 <sup>nd</sup>	1	55	67	66	S	S	S	2	2	1	1	1	1	1	smoky at 5 PM
3 <sup>rd</sup>	2	51	67	66	SE	W	S	1	2	1	2	1	1	1	do. at 12 M
4 <sup>th</sup>	2	55	71	67	E	E	E	1	1	1	2	2	2	2	do.
5 <sup>th</sup>	1	57	71	67	E	S	S	2	3	3	3	4	4	4	cloud at 9
6 <sup>th</sup>	1	62	72	67	E	W	S	1	2	2	2	2	4	4	do. at 10
7 <sup>th</sup>	3	58	58	57	SE	W	W	2	1	1	4	1	1	1	do.
8 <sup>th</sup>	1	52	71	66	E	S	S	2	2	2	4	1	1	1	do.
9 <sup>th</sup>	2	61	74	71	S	S	S	1	1	1	5	3	1	1	do.

**Figure 5. Weather observations taken at Vicksburg by Smithsonian Institution observer A.L. Hatch (March 1849). Only the top half of the form is shown to improve readability. From the official station history files at the National Climatic Data Center.**

According to the observation forms, A.L. Hatch observed/measured temperature, clearness of the sky, wind direction and force, cloud movement, and precipitation. Remarks regarding the daily weather also were included. Based on the observations, this station had a thermometer, rain gage, and probably, a wind vane. Wind force was most likely estimated. See the report on Minneapolis/St. Paul, MN (under this contract; see Bibliography) for additional information on weather observing instruments and instructions used by Smithsonian observers.

*Weather Observations by Army Surgeons (September 1866-June 1870)*

The first available observation in the NCDC database by Army surgeons at Vicksburg was on 1 September 1866 (Figure 6). The observations were almost continuous from 1 September 1866 to the last observation on 2 June 1870. The main exception was a month of missing observations in June 1869.

METEOROLOGICAL REGISTER.																					
Station <i>Vicksburg, Miss</i>		Lat.		Long.		Alt. of Bar. above		feet.													
1866 Month <i>Sept.</i>	THERMOMETER.				HYGROMETER.				WINDS.						WEATHER.			RAIN.		REMARKS.	
	7 A.M.	9 P.M.	9 P.M.	Daily Mean.	7 A.M.	9 P.M.	9 P.M.	Daily Mean.	7 A.M.	9 P.M.	9 P.M.	D.	F.	D.	F.	7 A.M.	9 P.M.	9 P.M.	Dir.		AMOUNT.
1	68	82	74	76.6	67	80	72	73	E	5	E	5	E	5	5	Fair	Fair	Fair			
2	69	81	73	78.33	68	79	71	72.66	E	5	E	3	E	3	3	Cloudy	Cloudy	Cloudy	10 AM	1.00	
3	67	79	71	72.33	66	77	70	71	W.E.	5	SE	5	E	5	5	Cloudy	Fair	Fair			
4	68	78	70	72	65	75	69	69.66	W.	3	E	3	E	3	3	Cloudy	Fair	Fair			
5	67	79	72	72.66	66	77	71	72.33	E	3	SE	3	SE	3	3	Fair	Fair	Fair	6 PM	1.60	
6	67	76	68	70.33	66	74	68	69.33	E	3	SE	3	E	3	5	Fair	Cloudy	Cloudy	10 AM	1.50	
7	68	78	70	72	68	77	70	71.66	W. W.	3	W. E.	3	W. E.	3	5	Fair	Cloudy	Cloudy	10 AM	1.50	
8	67	75	75	79	67	75	74	74.33	E	5	SE	5	SE	5	5	Cloudy	Cloudy	Cloudy	10 AM	1.50	
9	74	80	77	77	74	80	74	76.33	E	3	E	3	E	3	5	Cloudy	Cloudy	Cloudy	10 AM	1.50	
10	77	79	78	78.33	70	78	74	74	W	5	E	5	E	5	2	Cloudy	Cloudy	Cloudy	10 AM	1.50	
11	69	85	76	76.66	68	80	76	74.66	W.	3	W. W.	3	W.	3	10	2	Fair	Fair	Fair	10 AM	1.20
12	68	72	70	70	68	71	69	69.33	W.	3	E	3	E	3	5	Cloudy	Fair	Fair			
13	67	73	69	73	64	70	68	67.33	W. E.	3	W. E.	3	W. E.	3	2	Fair	Fair	Fair			
14	69	72	68	68	62	70	68	66.66	W. E.	3	W. E.	3	W. E.	3	3	Fair	Fair	Fair			
15	69	74	71	72.33	62	73	70	70.66	W.	3	E	3	E	3	5	Fair	Fair	Fair			

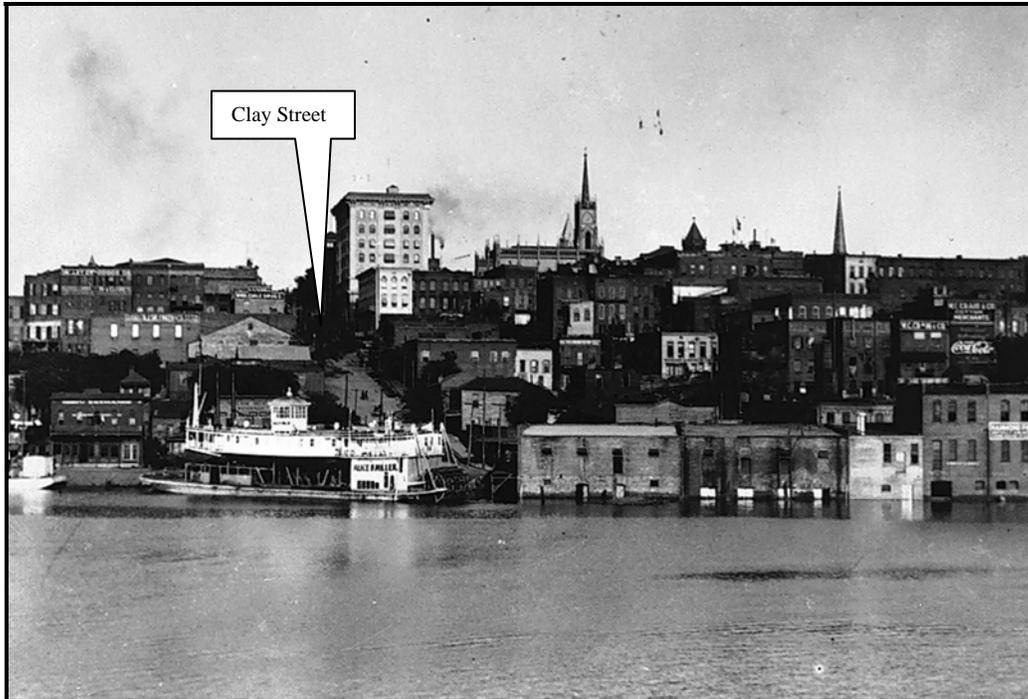
Figure 6. Weather observations taken at Vicksburg by U.S. Army surgeons (September 1866). Only the top half of the form is shown to improve readability. From the official station history files at the National Climatic Data Center.

Initially, the army surgeons measured/observed temperature, dew point temperature, wind direction and force, current weather, and rainfall (beginning, ending and amount). Significant weather was recorded under a “Remarks” section. The surgeons used a thermometer, psychrometer, rain gage, and probably a wind vane. Wind force likely was estimated. Instructions from the U.S. Army Surgeon General’s office in the 1860s regarding weather instruments used by field surgeons are contained in reports for Fort Snelling, MN, Fort Union, NM, and Fort Gibson, OK under this contract (see Bibliography).

In August 1868, observation forms were changed to include readings from maximum/minimum thermometers. However, Vicksburg surgeons stated on the forms that no maximum/minimum thermometers were at the station. On 1 July 1869, hygrometric measurements ceased at Vicksburg (action appears to be based on instructions from the Army Surgeon General’s office). No hygrometric measurements were made during the remainder of the observations (last observation was 2 June 1870).

### Signal Service and Weather Bureau Observations

The terrain of Vicksburg changes significantly, sloping down from east to west to the Mississippi River. Figure 7 shows the change in topography of the city from east to west. Although Signal Service and Weather Bureau stations were located within an area of three city blocks, the elevation of the instruments changed significantly.



**Figure 7. City of Vicksburg looking east (circa early 20<sup>th</sup> Century), showing the change in topography. All Signal Service/Weather Bureau weather observations were taken on the crest of the hill, or on the western down slope. From the U.S. Army Corps of Engineers, Vicksburg District.**

*Signal Service Observations (September 1871-October 1872)*

NOTE - From 1872 through 1888, the U.S. Signal Service conducted 14 inspections of its Vicksburg weather office. The inspection reports, available at the National Archives and Records Administration (NARA), contained drawings and textual information regarding weather instrument placement and exposure. The quantity and quality of information varied, depending primarily on the inspector. However, these reports contained revealing information not available from other sources, especially with regard to instrument location and exposure. Inspections at the Vicksburg Signal Service office were conducted on the following dates:

- |                       |                     |
|-----------------------|---------------------|
| 17-20 August 1872     | 25-27 December 1878 |
| 17 March 1873         | 25-27 April 1879    |
| 14-16 January 1874    | 24-26 March 1881    |
| 12-16 October 1874    | 17-18 April 1884    |
| 28-30 June 1876       | 2-4 May 1885        |
| 30 March-3 April 1877 | 14-18 April 1886    |
| 18-20 May 1878        | 14-15 January 1888  |

**8 September 1871 – 1 October 1872** – Signal Service office on the third floor of the Hunt Building on the west side of Washington Street (Figure 8).



**Figure 8. Location of Signal Service office 8 September 1871 through 1 October 1872. View is west. Available information indicates this was the original Hunt Building with the Signal Service office on the third floor in the back of the building on the right side, i.e., the northwest corner. Photograph taken by the author.**

One Signal Service inspection report (17-20 August 1872) was available while the weather station was located in the Hunt Building.

Barometer – The barometer was located in the southwest part of the Signal Service office near a window (Figure 9). Elevation of the barometer was 230 feet above sea level and 38 feet 10 inches above ground.

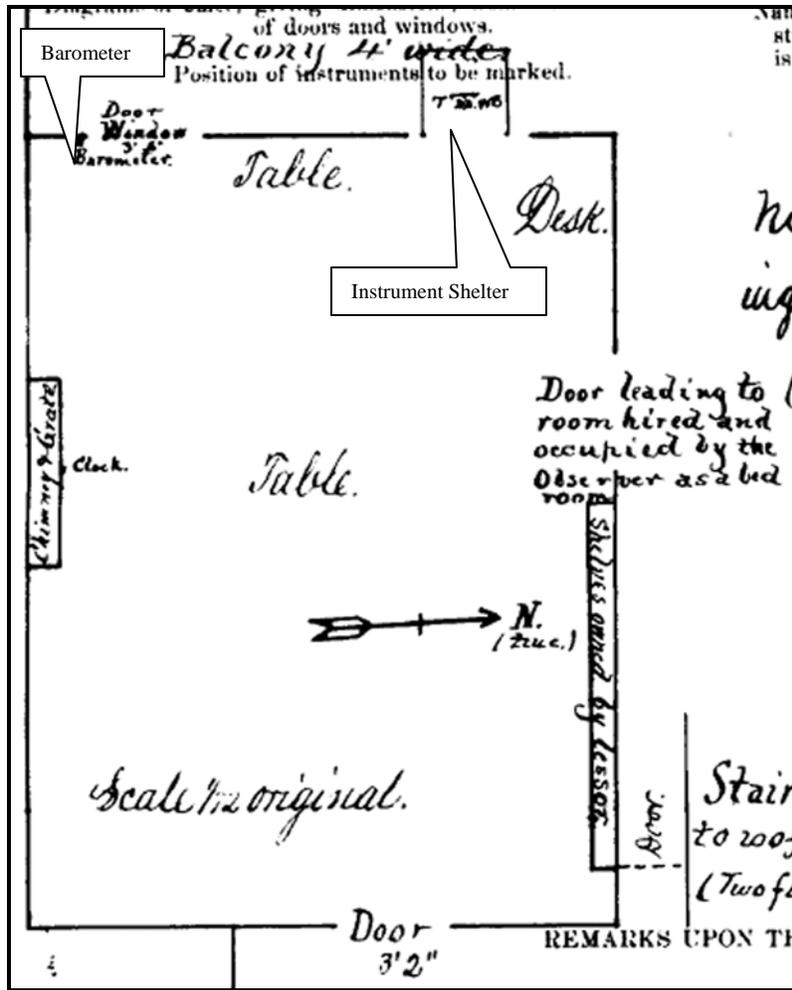
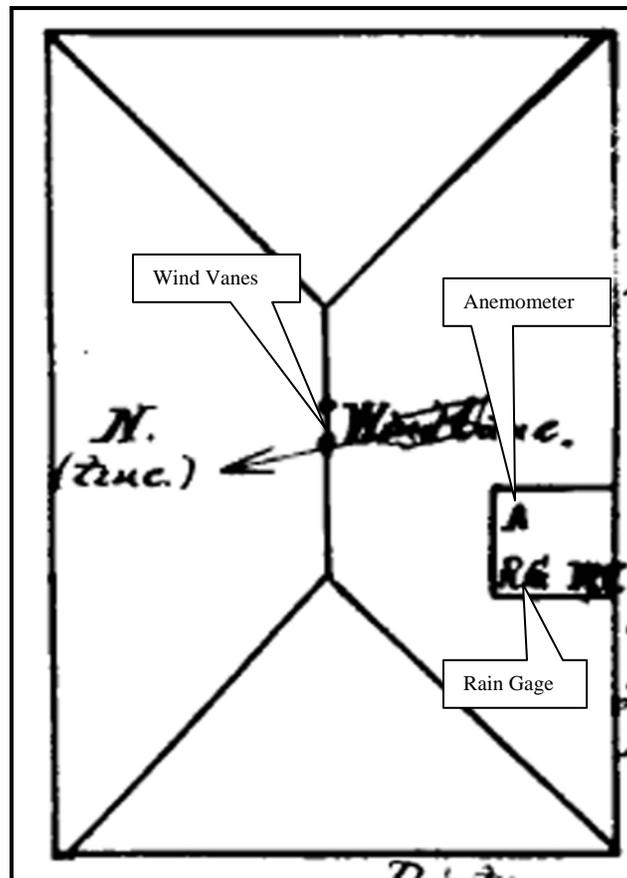


Figure 9. Signal Service office located on the third floor of the Hunt Building (17-20 August 1872). North is to the right. From the National Archives and Records Administration.

Instrument Shelter – The instrument shelter was in a window in the northwest part of the office (and building; see Figure 10) in a west facing window. The 1871 Signal Service Annual Report stated the instrument shelter was of the “standard” pattern. The shelter had lattice sides with a closed bottom. It was four feet high, two feet 3 inches wide, and two feet three inches deep. The inspection report in August 1872 stated, “The closed bottom is a necessity to prevent reflection from the balcony but two feet below it.” The exposed thermometer and hygrometer were 38 feet 6 inches above ground.

The August 1872 inspection report stated: “The shelter as now exposed is struck by the sun at 12 o’clock and the wood is heated up to 3 hours and 40 minutes for the 3:39 observation. The thermometer now must read from one to three degrees higher than it should. It must affect the temperature of the station and also the humidity of two reports, the 2 PM local time and the 3:39 telegraphic.”

Rain Gages – The standard 8 inch rain gage was on the roof of the building 76 feet above ground (Figure 10). The rain gage was two feet four inches above the roof.



**Figure 10. Roof of the Hunt Building showing the locations of the rain gage and wind instruments (17-20 August 1872). North is to the left side of the figure. The rain gage and wind instruments were located on the roof of a small shelter (six feet high, five feet wide, and five feet long) that was over a trap door on the roof. The roof was made of sheet metal and peaked at the center. From the National Archives and Records Administration.**

Wind Instruments – The wind instruments were on the roof of a shelter that covered a trap door on the roof of the building. The anemometer was 78 feet above ground and 4 feet above the roof. A large wind vane (12 foot) was 94 feet above ground and 22 feet above the roof. A small wind vane (3 foot) was 80 feet above ground and 8 feet above the roof.

Additional Equipment/Information – According to Weather Bureau records, river observations began in the Vicksburg vicinity in the early 1800s. Substation History documents indicated that intermittent river readings were made between 1828 and 1871 at Kleiston, MS, located two miles southwest of Vicksburg. Unofficial Signal Service river readings began at Vicksburg on 10 September 1871, with official readings starting 18 May 1873.

**1 October 1872 – 21 April 1885** – Signal Service office in the Baum Building on the northwest corner of Washington and Crawford Streets (Figure 11). The office was on the third floor of the building.



**Figure 11. Location of old Baum Building. Original Building no longer exists, but photograph shows the terrain around the site. View is northwest with Washington Street in the foreground and Crawford Street to the immediate right. Topography falls rapidly to the river just to the west (left) of the building. Photograph by the author.**

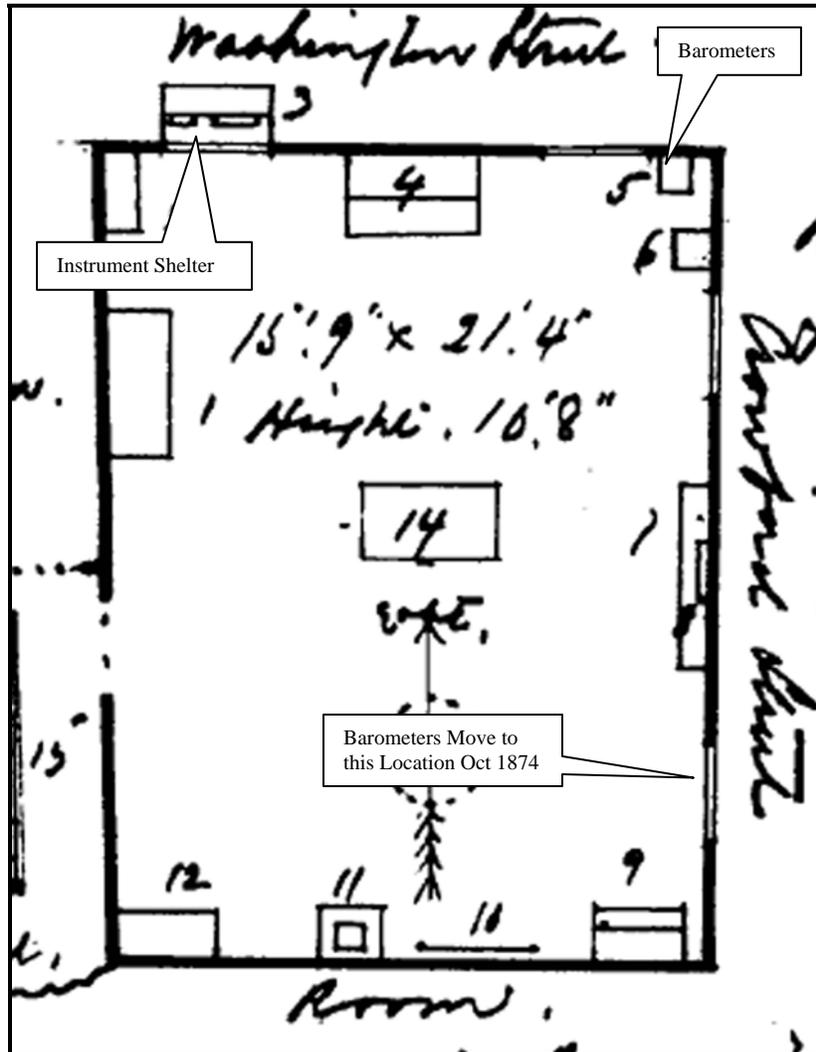
Ten Signal Service inspection reports were available for this site. The inspections were made on the following dates:

17 March 1873	18-20 May 1878
14-16 January 1874	25-27 December 1878
12-16 October 1874	25-27 April 1879
28-30 June 1876	24-26 March 1881
30 March – 3 April 1877	17-18 April 1884

Barometer – The barometer was located on the east wall of the office near the southeast corner (Figure 12) of the room. Elevation of the barometer was 244 feet above sea level and 31 feet above ground. A second barometer was added by the 14-16 January 1874 inspection and a third barometer was added by the 28-30 June 1876 inspection. Around March 1881, the number of barometers was reduced back to two.

The inspection report on 12-14 October 1874 stated comparison of one of the barometers to standard revealed irregularities due to leaking mercury. The

barometer could not be repaired and another was requisitioned. The inspector also was concerned the location of the barometers in the southeast part of the room was causing non-representative readings. The barometers were moved to the south side of the room. The barometers remained on the south side of the room as long as the station was at this site.

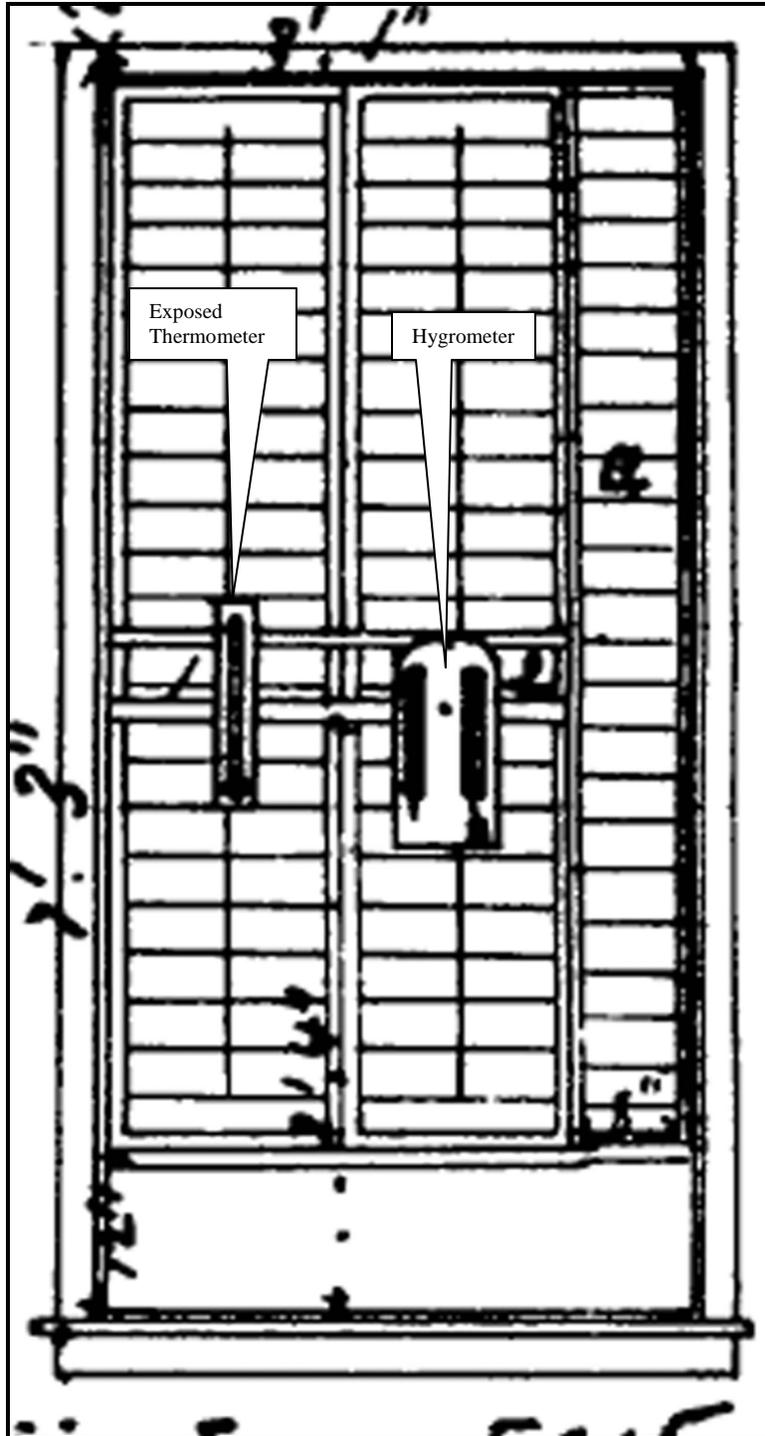


**Figure 12. Signal Service office located on the third floor of the Baum Building (17 March 1873). North is to the left. From the National Archives and Records Administration.**

Instrument Shelter – The instrument shelter was attached to a window on the east side of the building (Figure 12). The inspection reports expressed concern over the eastern exposure, as opposed to a northern exposure. The inspection on 28-30 June 1876 stated the sun shone on the shelter during the morning hours, causing temperature readings to be higher. The shelter remained in the east window as long as the station was at this site.

The shelter was six feet six inches high, three feet five inches wide, and three feet two inches deep. It was constructed of a single row of slats on the north side and a double row of slats on the east and south sides.

The exposed thermometer and hygrometer were 33 feet above ground and 14 inches from the window panes (Figure 13). By the 12-14 October 1874 inspection, maximum and minimum thermometers were added to the shelter and were located 32 feet above ground. On 28 December 1880, the hygrometer was replaced.



**Figure 13. Drawing of the instrument shelter in the east window of the Signal Service office (17 March 1873) located in the Baum Building. View is east. From the National Archives and Records Administration.**

Rain Gage – The standard 8 inch rain gage was located on the west roof of the building and was 52 feet above ground. The inspection on 17 March 1873 stated the rain gage was in good condition. The rain gage remained at this location as long as the station was at this site.

Wind Instruments - The wind instruments were located on the west roof of the building. The anemometer was 64 feet above ground and the wind vane 67 feet above ground. The inspection on 17 March 1873 stated the anemometer and wind vane were in good condition. By the 14-16 January 1874 inspection, the station had a large (12 foot) and a small (3 foot) wind vane. The vanes were 74 feet above ground in the January 1874 inspection report. By the 28-30 June 1876 report, the small wind vane was removed, leaving only the 12 foot vane. The inspection on 18-20 May 1878 stated the anemometer was replaced. It also stated the station had two anemometers, both at 67 feet above ground. Based on the 10 inspection reports, the wind instruments were not moved significantly while the station was at this site.

An anemoscope was added around June 1876 and a self register for the anemometer was added around May 1878.

Additional Equipment/Information – Weather Bureau records stated the office was moved from the previous site (Hunt Building) “...to secure better exposure of instruments...” The office had to move from this building because of a major fire.

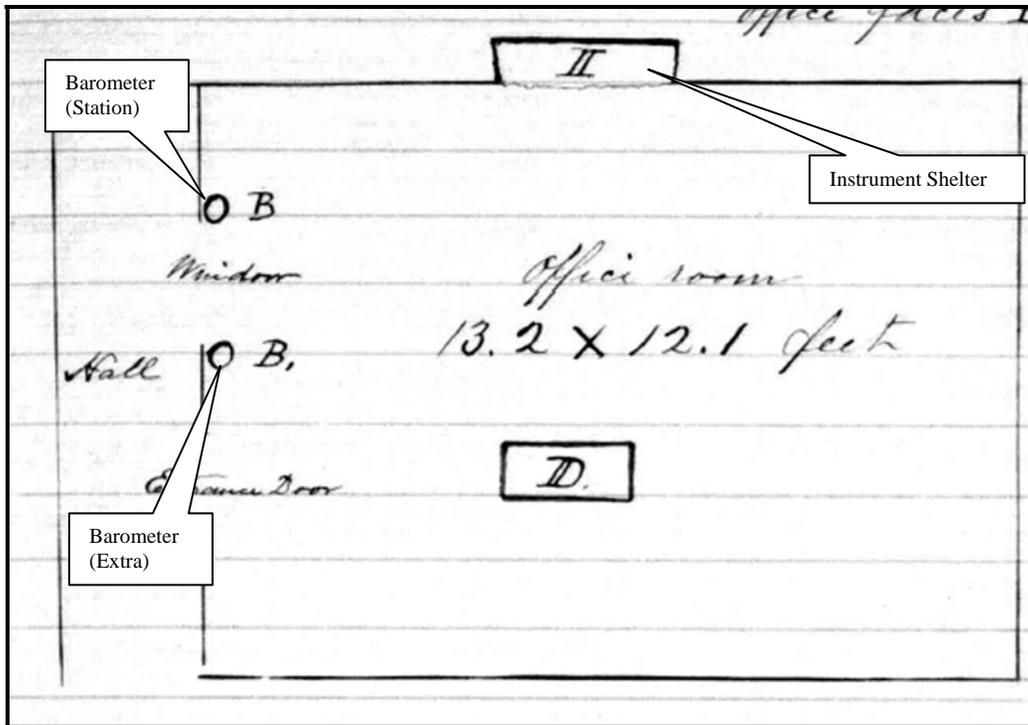
**21 April 1885 – 1 June 1885** – Signal Service office in the U.S. Engineers Building on the southeast corner of Cherry and China Streets (Figure 14).



**Figure 14. Location of Signal Service office from 21 April 1885 through 1 June 1885. View is southwest with China Street in the foreground. Building no longer exists but picture shows the terrain in the immediate area. Note that ground elevation decreases rapidly just west of the site. Picture taken by the author.**

The fire that destroyed the Baum Building on 21 April 1885 also destroyed various records and instruments of the Signal Service office. The Signal Service office was temporarily loaned a small room (13 feet by 12 feet) in the U.S. Engineers Building at China and Cherry Streets until permanent facilities could be found. One Signal Service inspection (2-4 May 1885) was conducted at this site.

Barometer – Two mercurial barometers were located on the north wall of the Signal Service office (Figure 15). A hallway was on the other side of the wall. Elevations of the barometers were 253 feet above sea level and 18 feet above ground.



**Figure 15. Signal Service office located at the U.S. Engineers Building at Cherry and China streets (2-4 May 1885). North is to the left. From the National Archives and Records Administration.**

Instrument Shelter – The original instrument shelter was destroyed in the fire at the Baum Building. The inspection report for 2-4 May 1885 stated the following:

“A rough instrument shelter single lattice was constructed by Copl. Byram from window blinds (slats) after the fire which destroyed the office on April 21, 1885... The shelter is a window shelter a like the usual pattern as possible.”

The shelter at the Engineers Building was located on the east wall of the office (Figure 15) with the back of the shelter facing east. The shelter was listed as 60 inches high, 29 inches wide and 17 inches deep. The exposed thermometer, maximum/minimum thermometers, and hygrometer were 19 feet above ground.

Rain Gages – The rain gage was destroyed in the fire, resulting in no gage at this station.

Wind Instruments – The wind instruments were destroyed in the fire, resulting in no wind instruments at this station

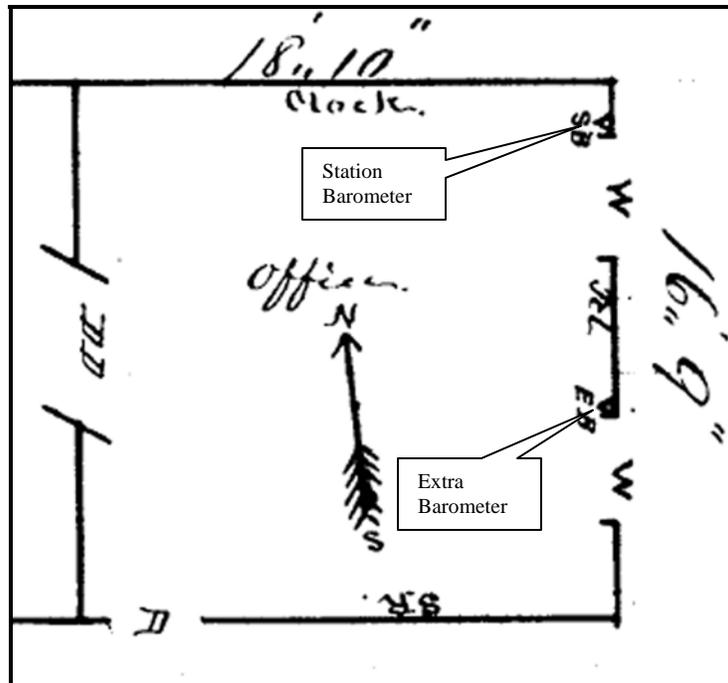
**1 June 1885 – 1 May 1886** – Signal Service office on the third floor of the Hall’s Building at 1304 Washington Street (Figure 16). The building was on the southwest corner.



**Figure 16. Location of Signal Service office from 1 June 1885 through 1 May 1886. View is southeast with Washington Street in the foreground. Building no longer exists but picture shows the terrain in the immediate area. Topography sloped up towards the south and sloped down significantly to the west toward the river (to the right in the photograph). Picture taken by the author.**

One Signal Service inspection (14-18 April 1886) was conducted at this site.

Barometer – The two barometers (station and extra; both mercurial) were located on the east wall of the office (Figure 17). Elevations of the barometers were 210 feet above sea level and 31 feet above ground.



**Figure 17. Signal Service office located in Hall's Building (14-18 April 1886). North is at the top of the figure. From the National Archives and Records Administration.**

Instrument Shelter – The instrument shelter was located on the roof of the building. The shelter was “single lattice” and was approximately three and one-half feet high, three feet wide, and three feet deep. The exposed thermometer, maximum thermometer, minimum thermometer, and psychrometer were 53 feet above ground.

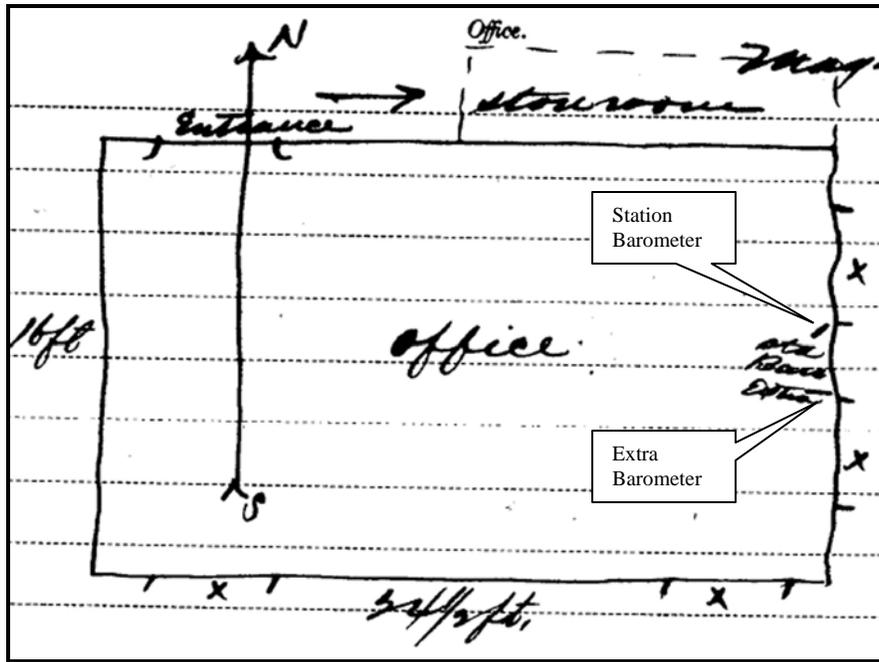
Rain Gages – The standard 8 inch rain gage was on the roof of the building and was 45 feet above ground. The inspection report on 14-18 April 1886 rated exposure of the rain gage as “bad” due to higher buildings to the south and to the east.

Wind Instruments – The wind instruments were on the roof of the building. The anemometer was 64 feet above ground and the anemoscopes (one large and one small) 51 feet above ground. The station also had an anemometer self-register. The inspection report on 14-18 April 1886 rated exposure of the wind instruments as “bad” due to higher buildings to the south and to the east.

**1 May 1886 – 1 July 1891** – Signal Service office in the Baum Building (3<sup>rd</sup> floor) on the northwest corner of Washington and Crawford Streets. Office was in the southeast corner of the building.

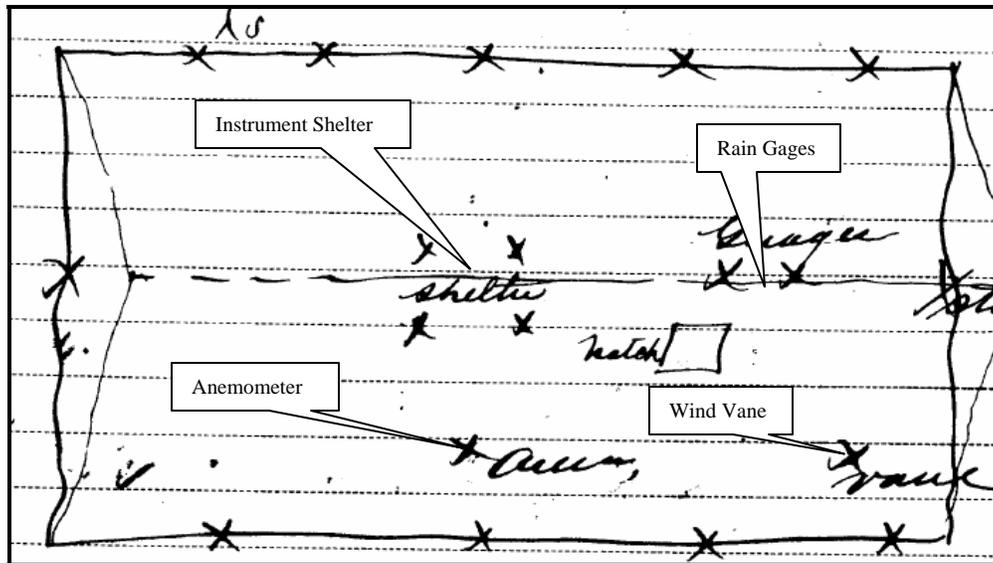
One inspection was conducted at this site (14-15 January 1888).

Barometer – The station and extra barometers were located on the east wall of the office (Figure 18). This wall bordered on Washington Street. Elevations of the barometers were 223 feet above sea level and 32 feet above ground.



**Figure 18. Signal Service office located in the Baum Building (14-15 January 1888). North is at the top of the figure. From the National Archives and Records Administration.**

Instrument Shelter – The instrument shelter was located on the roof of the building (Figure 19). The shelter was the same size as the one used at Hall’s Building. The exposed thermometer, maximum thermometer, minimum thermometer, and psychrometer were 60 feet above ground. The inspection report on 14-18 January 1888 stated the instrument shelter needed painting.



**Figure 19. Roof of the Baum Building showing location of the weather instruments (14-15 January 1888). North is at the top of the figure. From the National Archives and Records Administration.**

Rain Gages – The standard 8 inch rain gage and tipping bucket gage were on the roof of the building (Figure 19) and 54 feet above ground.

Wind Instruments - The wind instruments were on the roof of the building (Figure 19). The anemometer was 68 feet above ground and the wind vane 62 feet above ground. The station had a self-register for the anemometer. The November 1889 observation form stated the anemometer was changed at 12:30 p.m. on the 18<sup>th</sup>.

*Weather Bureau Observations (July 1891 Through 1955)*

**1 July 1891 – 1 March 1898** – Weather Bureau office on the 3<sup>rd</sup> floor of the Post Office Building on the southwest corner of Walnut and Crawford Streets.

Barometer – Elevation of the barometer was 254 feet above sea level.

Instrument Shelter – The exposed thermometer, maximum thermometer, minimum thermometer, and psychrometer were 65 feet above ground.

Rain Gages – The tipping bucket and standard 8 inch rain gages were 58 feet above ground.

Wind Instruments - The wind instruments were 73 feet above ground.

**1 March 1898 – 6 October 1914** – Weather Bureau office in Room 215 on the 2<sup>nd</sup> floor of the Post Office Building on the southwest corner of Walnut and Crawford Streets.

Barometer – Barometer and barograph were located on the 2<sup>nd</sup> floor of the building 247 feet above sea level. The barometers were moved from the south wall of the office to the east wall on 26 March 1913 with no change in elevation.

Instrument Shelter – The standard instrument shelter was located on the roof of the building. The shelter was three feet long, three feet wide, and three feet high, with the floor of the shelter approximately seven feet above the roof. The exposed thermometer and maximum/minimum thermometers were 65 feet above ground. The psychrometer was 62 feet above ground.

On 27 August 1900, a new standard instrument shelter was installed (same size), changing the elevation of the thermometers to 62 feet. Elevation of the psychrometer did not change. The thermometers and psychrometer were approximately seven feet above the roof. The Station History stated the “Former instrument shelter faced east. New one set up 27 August 1900 faced north.”

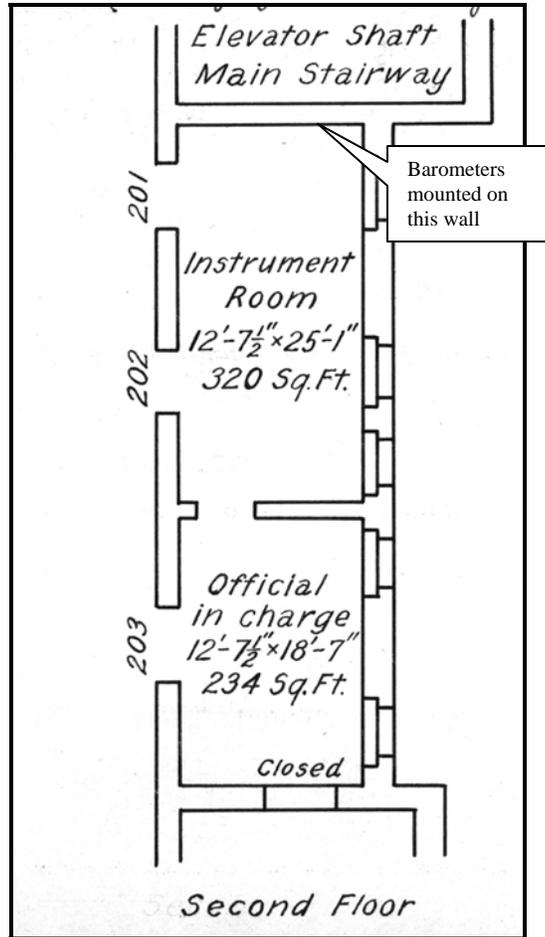
On 16 June 1914, the instrument shelter was placed on a platform on the roof of the building. The floor of the shelter was approximately 10 feet above the roof. The elevation of the thermometers and psychrometer increased to 65 feet above ground. No information was found indicating whether the shelter was moved to a different location on the roof.

Rain Gages – The top of the tipping bucket and standard 8 inch rain gages were approximately 3 feet above the roof and 58 feet above ground. On 27 August 1900, the elevation of the gages was lowered to 53 feet. No explanation was given for the change other than a new instrument shelter was installed. On 16 June 1914, the rain gages were placed on a platform on the roof of the building. The elevation of the gages increased to 58 feet above ground. No information was found indicating whether the gages were moved to a different location on the roof.

Wind Instruments - The wind instruments were on the roof of the building. The anemometer was 19 feet above the roof and 74 feet above ground. The wind vane was 20 feet above the roof and 75 feet above ground.

**6 October 1914 – 12 June 1937** – Weather Bureau office in Rooms 201-203 on the 2<sup>nd</sup> floor of the Post Office Building on the southwest corner of Walnut and Crawford Streets. Office moved to different rooms on the same floor and roof instruments remained unchanged (with the exception of the wind instruments which were moved to a different location on 8 July 1918).

Barometer – The two barometers (station and extra) were mounted to the north wall of the instrument room (Figure 20). The barometers were enclosed in a box with glass on three sides. The station also had a barograph (Richards). Elevation of the barometers was 247 feet above sea level.



**Figure 20. Location of barometers in Room 201 of the Post Office Building (12 June 1937). North is toward the top of the page. From the official station history files at the National Climatic Data Center.**

Instrument Shelter – The standard instrument shelter was located on the west side of the building on the roof. The floor was approximately 10 feet above the roof. The shelter was three feet long, three feet wide, and three feet high. The exposed thermometer, maximum thermometer, minimum thermometer, and psychrometer (whirling type) were 11 feet above the roof and 65 feet above ground. The station also had a thermograph and telethermoscope. Figure 21 is a schematic showing the locations of the instruments on the west roof of the Post Office Building and Figure 22 is a current picture showing the general location of the instruments.

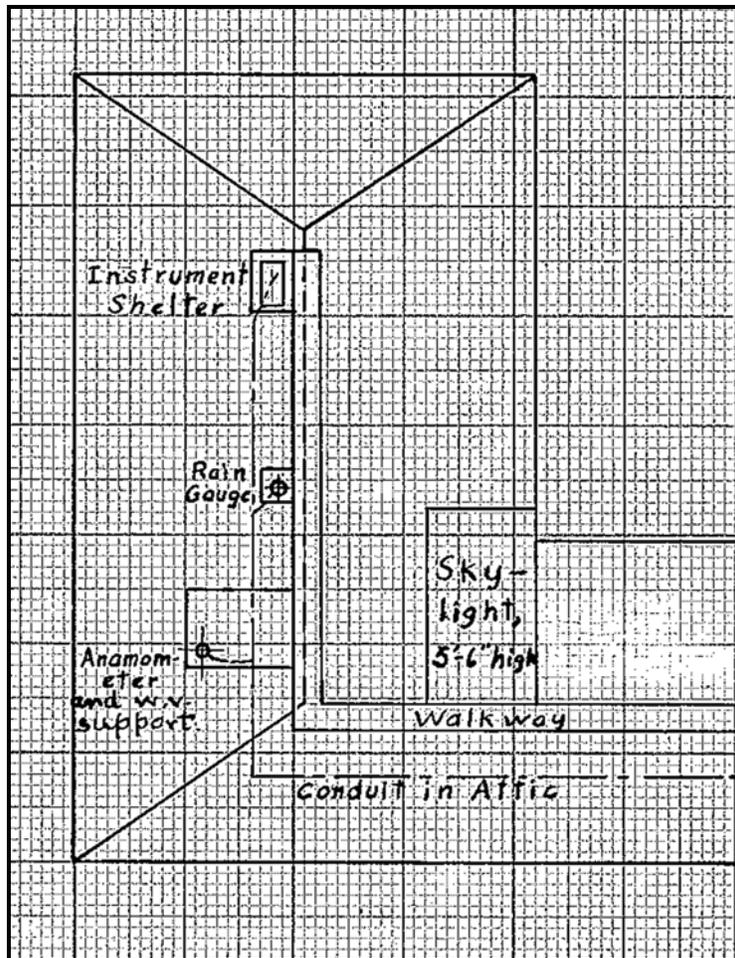


Figure 21. Locations of weather instruments on the western roof of the Post Office Building (28 April 1932). North is at the top of the figure. The instrument shelter was approximately 17 feet from the rain gauges and the rain gauges approximately 14 feet from the anemometer and wind vane. From the official station history files at the National Climatic Data Center.



**Figure 22. Current photograph showing the back of the Post Office Building and the general location of the weather instruments on the west roof (see Figure 21). View is north-northwest. Photograph by the author.**

Rain Gages – The tipping bucket and standard 8 inch rain gages were approximately 3 feet above the roof and 58 feet above ground. The gages were located on the west-southwest side of the building (see Figures 21 and 22).

Wind Instruments - The anemometer (4 cup) was 19 feet above the roof and 74 feet above ground. The wind vane (6 foot) was 20 feet above the roof and 75 feet above ground. The wind instruments were moved on 8 July 1918 to a different location on the roof of the building which was approximately 60 feet south and slightly west of previous location (Figures 21 and 22). No significant change in elevation occurred. Figure 23 shows the location of the wind instruments in the 1920s when the instruments were on the southwest part of the building.



**Figure 23. Wind instruments on top of the Post Office Building (circa 1920s). View is southwest. From the official station history files at the National Climatic Data Center.**

Additional Equipment/Information - Weather Bureau inspections rated the exposure of the roof instruments as “good.” A sunshine recorder was located on the roof of the instrument shelter. A nephoscope was located at the office, but Weather Bureau inspections indicated the instrument was not used.

**12 June 1937 through 1955** – Weather Bureau office in Rooms 500, 501-A, and 501 in the Post Office and Courthouse on the southwest corner of Crawford and Monroe Streets.

Barometer – Elevation of the barometers (made by Green) was 295 feet above sea level. A seven-day barograph also was at this station and in November 1938, was changed to a four-day barograph (aneroid-Friez).

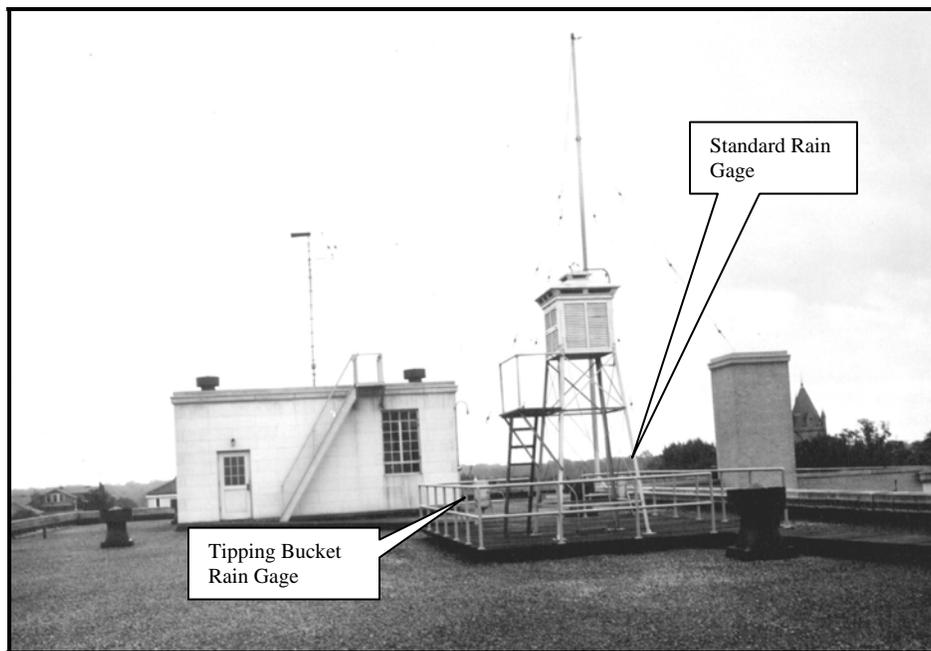
Instrument Shelter – The standard instrument shelter (by 1 April 1938 the shelter was referred to as a “large” type) was on the roof of the building with the floor of the shelter approximately 10 feet above the roof. The exposed thermometer, maximum thermometer, minimum thermometer, and psychrometer (whirling type) were approximately 10 feet above the roof and 82 feet above ground. A

thermograph and telethermoscope were located at this station. A hygrograph was installed around October 1950.

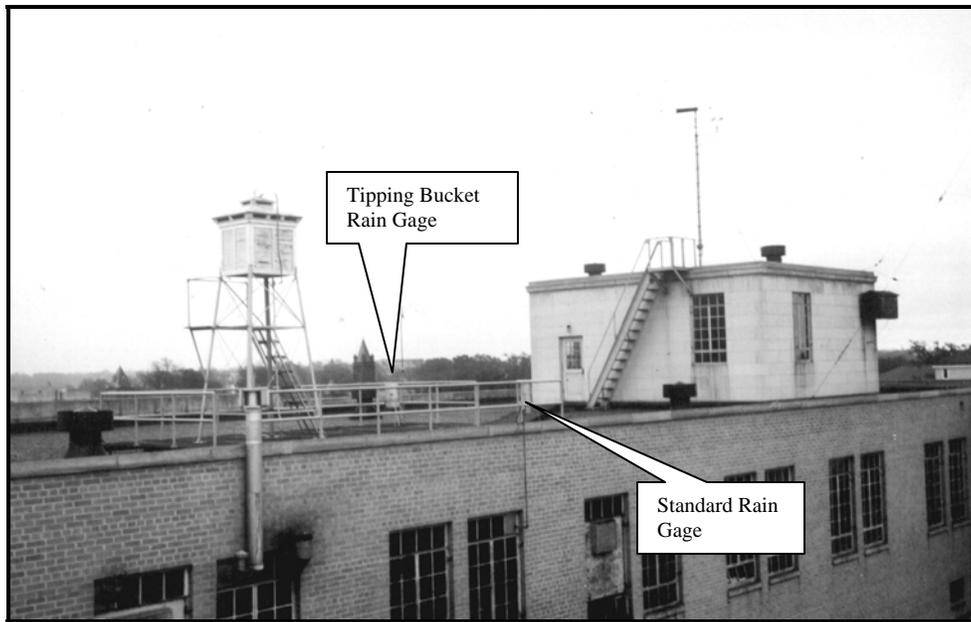
On 18 July 1949, the instrument shelter was moved 20 feet north of the previous location. Weather Bureau Station History stated, “Instrument shelter moved to new position on roof shortly after Engineers installed air conditioning fan in line with shelter on roof.” No change in elevation occurred. A Weather Bureau report on 1 June 1951 stated:

“Roof location places instrument shelter well above most surrounding buildings providing good free air flow; both minimum and maximum temperatures less extreme than at ground level.”

Figures 24 and 25 show the weather instruments on the roof of the Post Office and Courthouse on 8 April 1942 and Figure 26 shows the locations of the weather instruments on 15 November 1949. Figure 27 shows a broad view of the instruments in the early 1950s.



**Figure 24. Instrument shelter, rain gages, and wind instruments on the roof of the Vicksburg Post Office and Courthouse (15 November 1942). View is east southeast. From the official station history files at the National Climatic Data Center.**



**Figure 25. Instrument shelter, rain gages, and wind instruments on the roof of the Vicksburg Post Office and Courthouse (15 November 1942). View is northeast. From the official station history files at the National Climatic Data Center.**

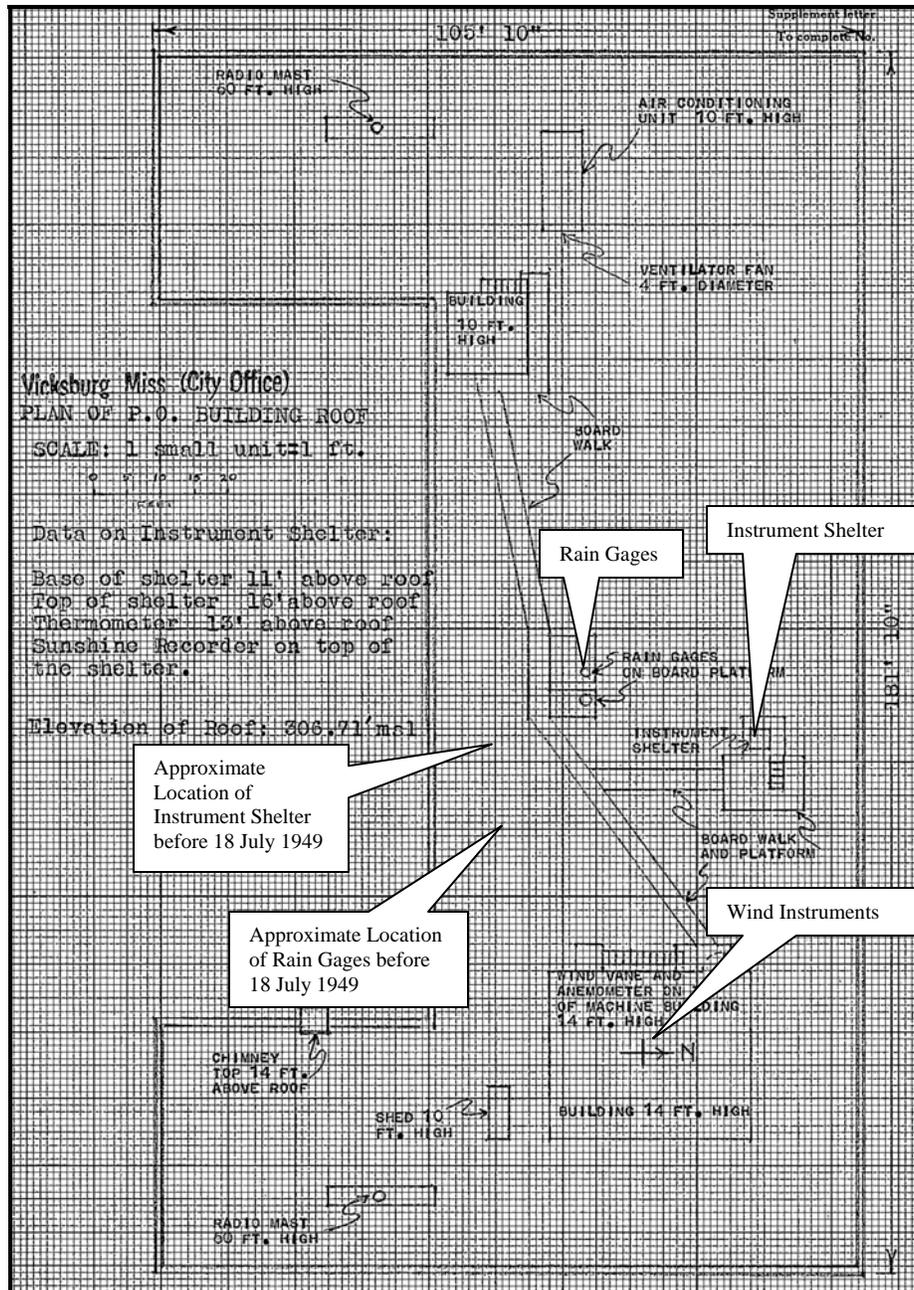
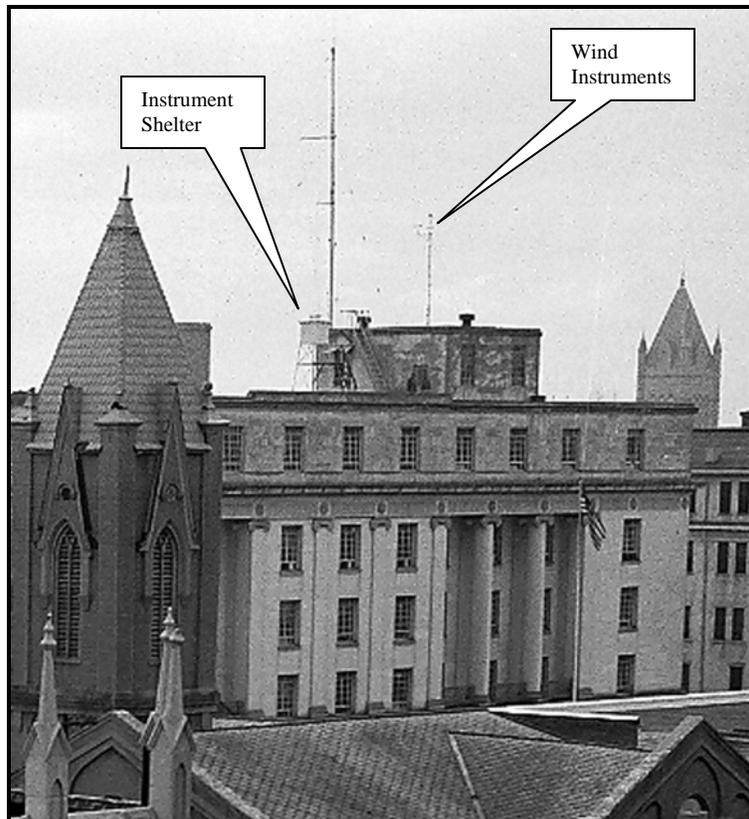


Figure 26. Roof of the Vicksburg Post Office and Courthouse (15 November 1949) showing the location of weather instruments. North is to the right of the figure. Roof was approximately 182 feet long (top to bottom) and 106 feet wide at the widest part (left to right). From the official station history files at the National Climatic Data Center.



**Figure 27. Weather instruments on top of the Post Office and Courthouse (circa 1950s). View is northeast. From the U.S. Army Corps of Engineers, Vicksburg District.**

Rain Gages – The tops of the tipping bucket (Friez) and standard 8 inch rain gages were 3 feet above the roof and 74 feet above ground. An inspection report on 17 December 1937 contained the following:

“The rain gage (tipping bucket) is in excellent position, but a half-inch lighting conduit rises near it, with a large globe exposed at a height of about six feet above the roof, and this light standard is curved at the top to put the socket opening downward, with result that the whole structure must undoubtedly catch and drip rainfall. The light fixture is possibly near enough to permit northeast winds of moderate strength to blow some of the drip into the opening of the gage.”

Figures 24, 25, and 26 show the locations of the rain gages.

Wind Instruments - The anemometer (4 cup) was 31 feet above the roof and 102 feet above ground. The wind vane (4 foot) was 33 feet above the roof and 104 feet above ground. A three-cup anemometer was added by 15 April 1945. A report on 1 June 1951 stated the anemometer was made by Robinson. The report also stated, “No obstructions to free wind movement at anemometer level.”

Figures 24, 25, 26, and 27 show the wind instruments on top of the Post Office and Courthouse Building.

Additional Equipment/Information – The publication “Local Climatological Data” contained the following information:

“WBO moved to present location (Post Office and Courthouse) due to inadequate space in Public Building. The roof location of thermometer shelter tends to give somewhat less extreme temperatures (both in summer and winter). Measurements of relative humidity discontinued at City Office December 31, 1940 due to Airport Station maintaining record of same. Quite a few records were destroyed by fire April 21, 1885.”

The following was contained in a Weather Bureau inspection report on 17 December 1937:

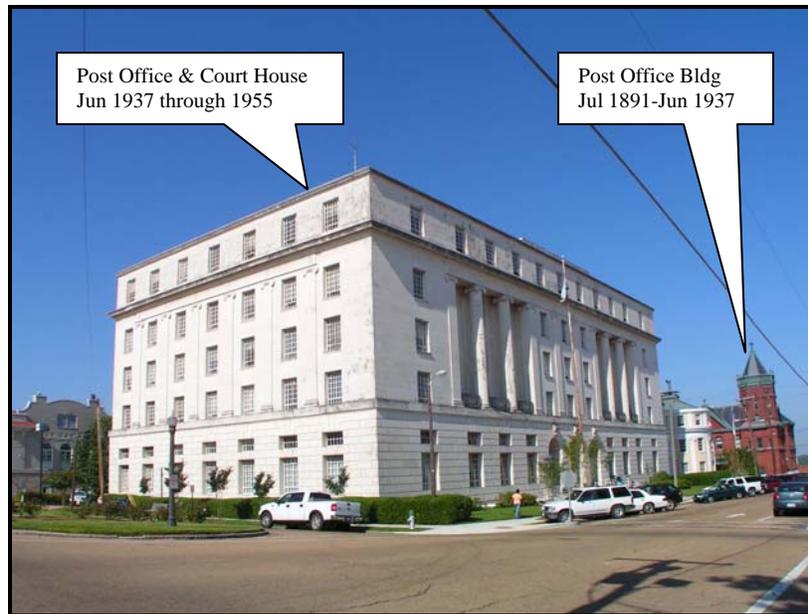
“The exposures of roof instruments on the new Post Office Building are unusually good. The building is large, with a full flat roof, and its location on the top of the bluff gives unobstructed wind movement.”

The sunshine recorder was on top of the instrument shelter.

A Weather Bureau report on the station prepared 1 June 1951 contained the following perception:

“Practically all the eighty years of weather records at Vicksburg have been obtained on the roofs of buildings in the downtown section; since 1888, the records have been within a block of the same location. The present location is on the roof of the 5-story U.S. Courthouse and Post Office Building. The roof location, which places the thermometers 82 feet above the ground, results in less extreme temperatures both in winter and summer. Afternoon readings in the summer may be 2-4 degrees cooler than at ground level while favorable radiation conditions in the fall and winter season will occasionally result in ground temperatures 10-15 degrees colder than in the instrument shelter on the roof. The Illinois Central Railroad yards and shop, along with nearby factories, provides a smoke source about one mile southwest of the Post Office.”

Figure 28 shows the proximity and terrain change around the two Post Office Buildings where weather observations were taken from 1891 through 1955. Terrain slopes down toward the west from the new Post Office to the old Post Office.



**Figure 28. Proximity of the two Post Office buildings where weather observations were taken in Vicksburg from July 1891 through 1955 (current photograph). View is southwest. Monroe Street is at the left of the photograph and Crawford Street is to the right. Photograph taken by the author.**

*Aviation Weather Observations (September 1938 through 1955)*

**2 September 1938 – 22 May 1950** – Civil Aeronautical Administration (CAA) office in the Administration Building at the old Municipal Airport. Station initially listed as an U.S. Airway Communication Station with the name changed to CAA office/station around 1940.

Barometer – The barometer (made by Green) was mounted on the northeast wall of the office (see Figure 29) at an elevation of 263 feet above sea level. The station also had a seven day barograph, mounted on the northeast wall of the office (four feet above ground). By December 1940 the barograph was replaced with a four-day variety. A Weather Bureau inspection report on 2 March 1940 stated the barometer and barograph were moved to the center of the northeast wall of the office because it was exposed to late afternoon sun.

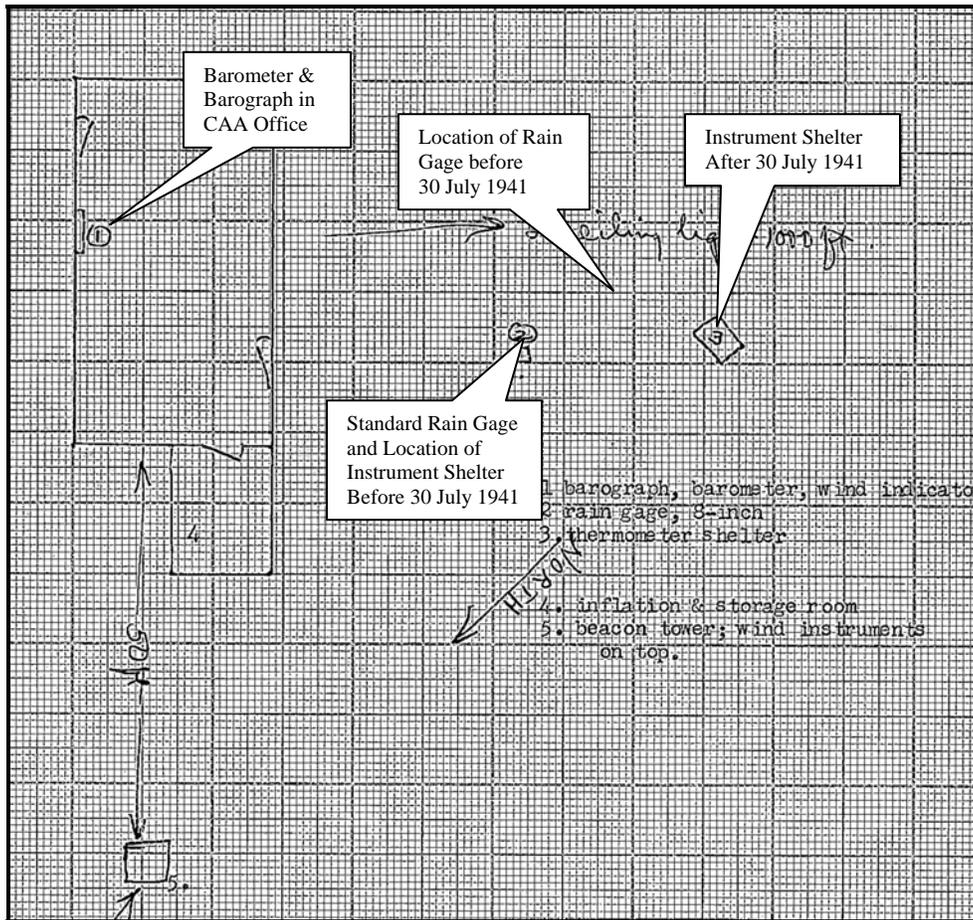
Instrument Shelter – The airway instrument shelter was located over sod 18 feet southwest of the Administration Building. The floor of the shelter was four feet above ground. On 15 December 1940, the shelter was changed to a cotton region type. Dry bulb thermometer, maximum/minimum thermometers, and psychrometer (sling and fan) were approximately five feet above ground.

On 30 July 1941, the instrument shelter was moved to the end of a concrete apron approximately 32 feet southwest of the Administration Building (see Figures 29,

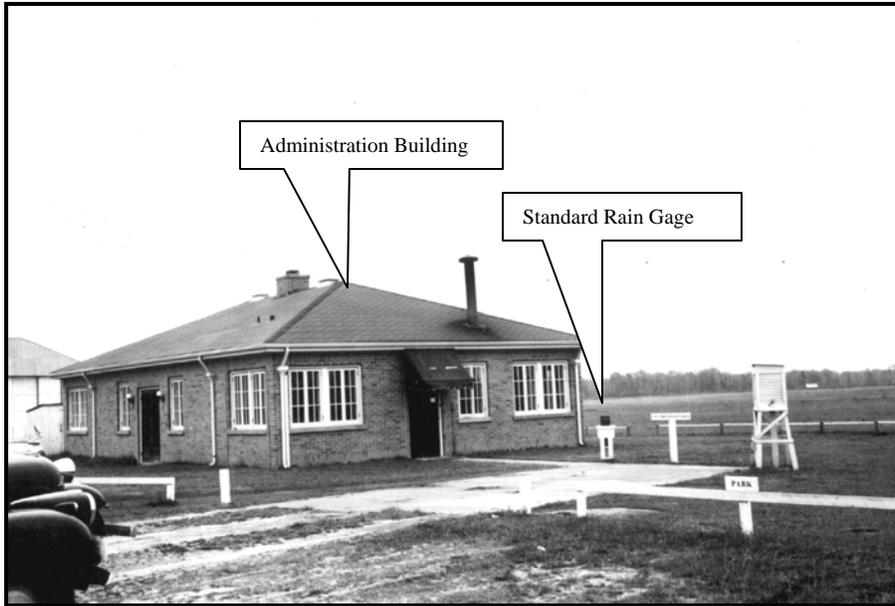
30, and 31). Weather Bureau reports stated there were “no troublesome influences” and the exposure was rated as excellent.

Rain Gages – An eight inch rain gage was three feet above ground and located approximately 28 feet southwest of the Administration Building. On 30 July 1941 the rain gage was moved approximately 10 feet northeast to a position 18 feet southwest of the Administration Building. See Figures 29, 30, and 31. Exposure at both locations was rated as satisfactory.

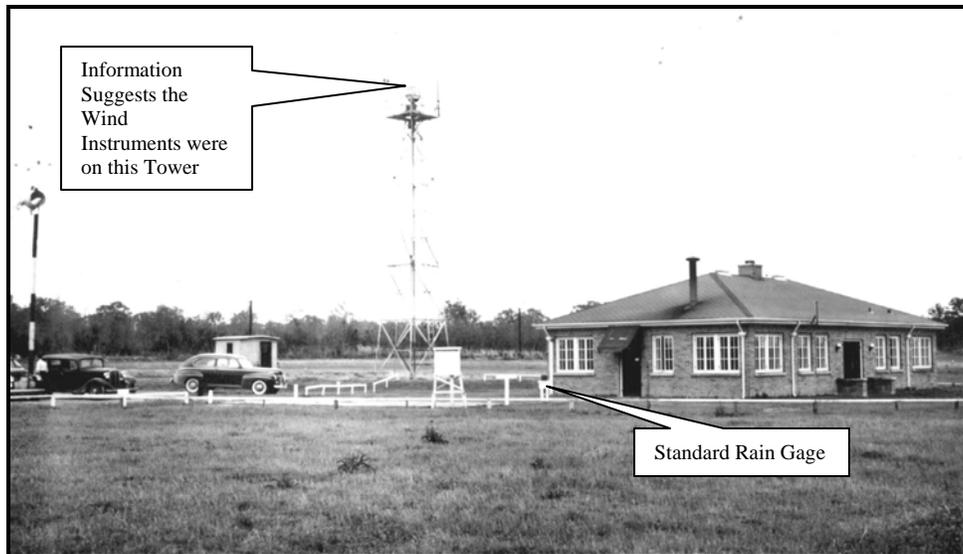
Wind Instruments – The anemometer (3 cup) and wind vane (3 foot metal) were 57 feet above ground. The wind instruments were on the beacon tower 160 feet from the CAA office but no information could be found regarding the exact location of the instruments. See Figure 31.



**Figure 29. Locations of weather instruments at the CAA office at the Vicksburg Municipal Airport (30 July 1941). North is toward the lower left of the figure. From the official station history files at the National Climatic Data Center.**



**Figure 30. Instrument shelter and rain gage at the CAA office at the old Municipal Airport (8 April 1942). View is east. From the official station history files at the National Climatic Data Center.**



**Figure 31. Instrument shelter and rain gage at the CAA office at the old Municipal Airport (8 April 1942). View is north. From the official station history files at the National Climatic Data Center.**

**22 May 1950 – 30 September 1950** – Civil Aeronautics Administration office on the 2<sup>nd</sup> floor of the Administration Building at the new Vicksburg Municipal Airport. The CAA station closed 30 September 1950.

NOTE – A conflict exists with respect to the actual days the CAA instruments were moved to the new airport. Station History forms and Local Climatological Data all indicated the change occurred 22 May 1950; however, Surface Weather Observation forms (WBAN 10 D) indicated the change occurred 1 May 1950. This conflict could not be resolved.

Barometer – Elevation of the barometer was 122 feet above sea level. A 4-day barograph was at this station and was 14 feet above ground.

Instrument Shelter – The cotton region instrument shelter was located over sod, 50 feet east of the Administration Building (see Figures 32 and 33; the shelter location remained unchanged when the CAA office closed and the observing site became a SAWRS). The shelter was three feet long, two feet wide, and two feet high. The floor of the shelter was four feet above ground. Dry bulb thermometer, maximum/minimum thermometers, and psychrometer were approximately five feet above ground.

Rain Gages – An eight inch rain gage was four feet above ground. No confirmation could be found, but most likely, the rain gage was located near the instrument shelter (see Figure 32).

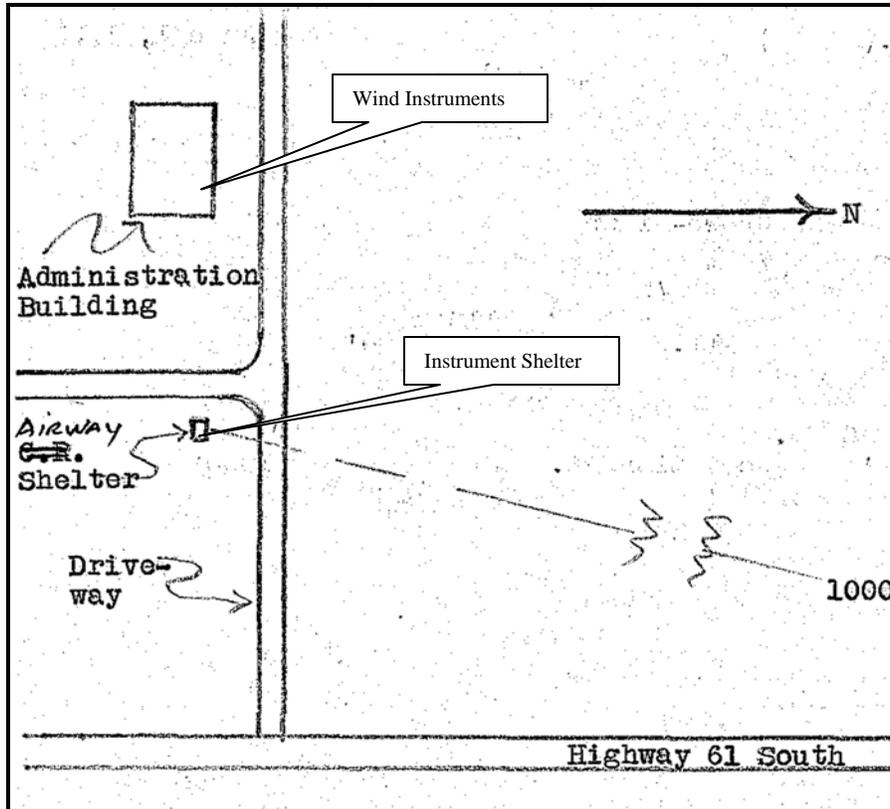
Wind Instruments – Wind instruments were on the roof of the Administration Building. The anemometer and wind vane were 13 feet above the roof and 36 feet above ground (see Figure 34; the location of the wind instruments remained unchanged when the CAA office closed and the observing site became a SAWRS).

**16 October 1950 through 1955** - Supplementary Aeronautical Weather Reporting Station (SAWRS) on the 1<sup>st</sup> floor of the Administration Building in the new Vicksburg Municipal Airport. The station was operated by Southern Airways.

Barometer – This station had an altimeter setting indicator (Kollsman) in the Southern Airways office, located five feet above ground. No mercurial barometer at this station. Field elevation was 111 feet.

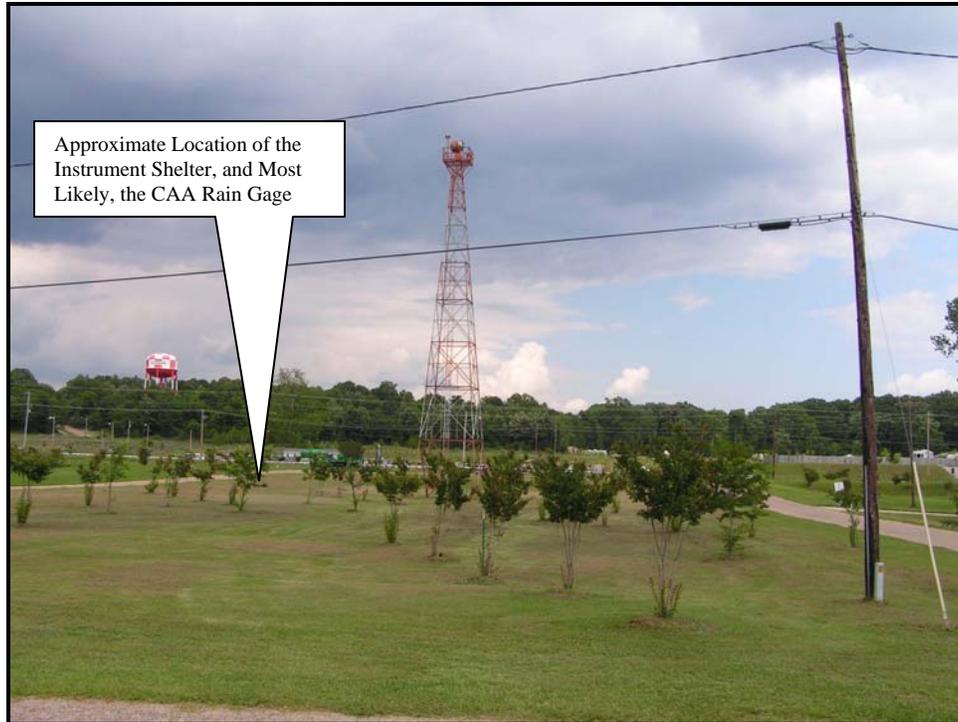
Instrument Shelter – The airway instrument shelter was approximately 60 feet east of the Administration Building. Exposure was rated as excellent by the Weather Bureau. Location of the shelter did not change from CAA observations to the SAWRS although the cotton region shelter was replaced by an airway shelter.

Dry bulb thermometer and psychrometer were approximately five feet above ground. The instrument shelter, thermometers, and psychrometer were furnished by the Weather Bureau. Figures 32 and 33 show the location of weather instruments associated with the SAWRS and the CAA office/station.



**Figure 32. Location of instrument shelter and wind instruments for the CAA office, as well as the SAWRS, at the new Municipal Airport (1 June 1951). North is to the right. From the official station history files at the National Climatic Data Center.**

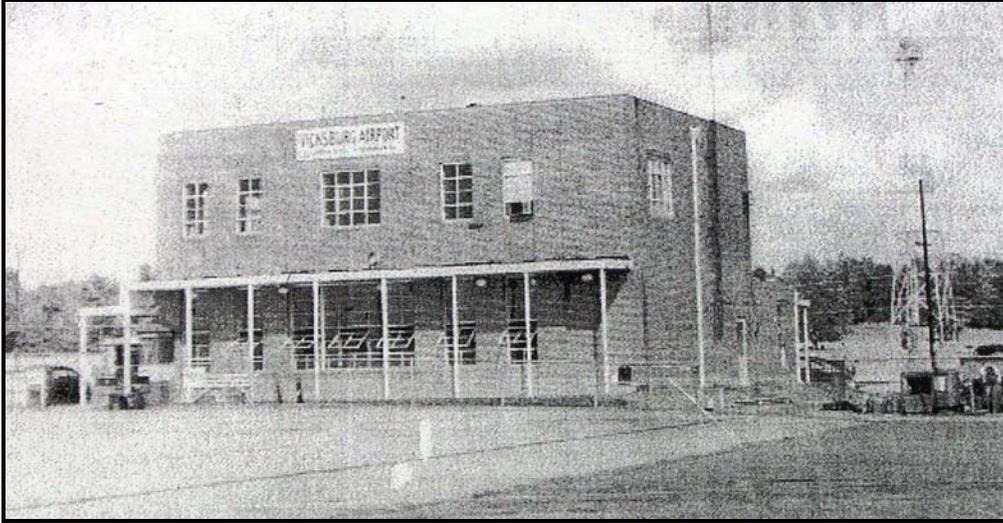
Figure 33 shows the approximate location of the instrument shelter and probably the site for the rain gage.



**Figure 33. Current photograph showing the approximate location of the SAWRS and CAA instrument shelter. The CAA rain gage also was likely at this location (the SAWRS did not have a rain gage). Different roads than shown in the photograph were in existence in the early 1950s. View is east. Photograph taken by the author.**

Rain Gages – No rain gage at this station.

Wind Instruments – Wind instruments were on the roof of the Administration Building (Figure 34). The anemometer was 6 feet above the roof and 30 feet above ground. The wind vane was 7 feet above the roof and 31 feet above ground. The wind instruments were furnished by Southern Airways. The location of the wind instruments did not change, although the actual instruments changed (replaced by Southern Airways). The wind instruments furnished by Southern Airways were installed 13 November 1950 and were manufactured by Aircraft Components Instrument Company.



**Figure 34. Airport Administration Building (circa 1950s) that housed the CAA office and Southern Airways, and also supported the wind instruments. View is southeast. From the Director of the Vicksburg Municipal Airport.**

Additional Equipment/Information – Although the SAWRS was converted to active status on 16 October 1950 and some hourly observations were taken on that date, actual operation on a strictly scheduled basis did not begin until 25 October 1950.

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## APPENDIX

### Methodology

Station history files at the National Climate Data Center (NCDC) provided descriptions of weather station locations beginning in 1849, i.e., during the Smithsonian years, and continued through the Signal Service years, and into the early part of the 20<sup>th</sup> Century under the U.S. Weather Bureau.

Entries from local Climate Record Books at the NCDC provided the backbone for locations and general exposures for instrument shelters (especially thermometers), rain gages, and anemometers/wind vanes for the Vicksburg stations (city office and airport locations) from November 1871 into the 1950s. Numerous Station History reports prepared in the 20<sup>th</sup> Century were instrumental in defining specific instrument elevation heights at both the Weather Bureau City Offices and at the CAA and SAWRS Airport Stations.

Specific building names and street addresses from different sources confirmed the locations of the Signal Service and Weather Bureau city offices from 1871 through 1955. During the latter time period of this study, Weather Bureau officials routinely documented station history and instrument status through forms entitled, Description of Topography and Exposure of Instruments, Report of Elevation and Position of Instruments, and Surface Weather Observations. Information on these forms provided significant detail regarding Vicksburg city offices, as well as the CAA and SAWRS stations at the airports.

Tracking office location and instrument exposure on a yearly basis was important to ensure no information gaps existed. This yearly information was obtained from the Annual Reports of the Chief Signal Officer for the 1870s, 1880s, and early 1890s, as well as from the Annual Reports of the Weather Bureau from 1892 through 1930 (Weather Bureau Annual Reports stopped in 1930 to save money during the Depression). Weather Bureau Annual Reports were more complete for this project than Signal Service versions. Information consistency for the 1940s and early 1950s was maintained from the wealth of historical records during the 1950s.

Considerable information regarding the early Signal Service observing stations in Vicksburg was available from 14 station inspection reports located at the National Archives and Records Administration (NARA). These inspections provided drawings and detailed textual information on the placement and exposure of weather instruments at the Signal Service stations in Vicksburg.

Information regarding duration of observations by Smithsonian Institution weather observers in the Vicksburg area was obtained from yearly Smithsonian Institution reports, as well as from the NCDC data base.

General historic information for the Vicksburg area was found on various web sites. Archives at the Vicksburg Public Library and Mississippi Department of Archives and History were helpful in answering specific questions regarding building and station locations.

Other information and data sources checked (by person, telephone, or through the Internet) during this study were: the Signal Corps Museum (Augusta, GA), the Vicksburg Historical Society, Vicksburg National Military Park, and the Vicksburg Old Courthouse Museum. Also, relevant information regarding the Weather Bureau, Signal Service, and Army Medical Department was obtained from the Dallas, TX Public Library, Oklahoma State University Library, National Library of Medicine at Bethesda, MD, and the NOAA Library.